The following appear to me to be (*primâ facie*) the complaints which may be reasonably brought against the commissioners:—

1. That having been commissioned to make a survey of the quarries throughout the United Kingdom, they omitted to examine those of Ireland.

2. That a very superior Irish stone having been offered to them, without charge for royalty, they declined the offer.

3. That they recommended (among other reasons), "for facility and economy of conversion," a stone which could not be procured either in sufficient quantity, or in blocks of a sufficient size.

4. That on the failure of this quarry, they did not go to another which might be considered to stand next in their report, but to a new quarry, which has also proved insufficient to supply the required quantity.

5. That this deficiency of supply has not been made good by application to the quarry at first so strongly recommended, which is said to contain stone exactly similar to that of the new quarry, and which might be expected to be at the least capable of supplying *some* stone; but that two other quarries have been applied to which are not mentioned in the Commissioners' report. In short, that after all the parade of the commission, the supply of stone has been obtained from three several quarries, not one of which was recommended, nor even its existence hinted at, in the report of the Commissioners.

This seems a strong case against them, and certainly evinces a want of care in the first survey, and some inconsistency in their subsequent conduct, but I have no doubt that many of the objections are capable of satisfactory explanation.

The first charge, I think, a very dubious one, and rests upon the simple question of whether they were commissioned to visit the Irish quarries or not.

The second is entirely refuted by the very judicious remarks with which you have favoured your readers, and by the fact that in colour and general appearance the stone in question was altogether unsuitable to the purpose.

The third certainly evinces some want of care. As to the beauty and probable durability of the Bolsover stone, there can be no doubt, but the thinness of the majority of the beds, which is the great objection, is obvious on a slight examination of the quarry; though the Commissioners, in their just admiration of the quality, might have flattered themselves that by sinking deeper or opening new quarries in the neighbourhood, better blocks could be obtained. It should also be borne in mind that they do not distinctly specify the quarry, but recommend the stone of Bolsover Moor *and its neighbourhood.*

The fourth objection at first sight appears reasonable, but on consideration I think no one will deny that the stone first recommended having proved insufficient in quantity, Mr. Barry was quite right in adopting that which most resembled it in quality, though he had not seen it when acting on the commission; being also within a few miles of Bolsover, it may (though by a little stretch of the meaning of the words) be considered to be in "its neighbourhood."

The fifth objection I am unable satisfactorily to answer. I do not see why the Bolsover stone should not have been used, so far as it would go, in supplying the deficiency (which I believe to be only temporary) in the supply of the other quarry. The quality of the Bolsover appears to me to be far superior to the Anston and infinitely better than the Steetley (which latter, however, I think is only used internally), and there certainly is stone at Bolsover of sufficient size, though not in large quantities. The circumstance of the Woodhouse quarry being only lately discovered (or rather *re*-discovered), removes the objection of its not being in the report; but the Steetley and Anston being old and well-known quarries, it certainly looks like negligence not to have reported on them, and like inconsistency to have selected them though not mentioned in the report. One would certainly have expected that before going to these quarries, consistency would have prompted strong measures, such as sinking shafts, opening new quarries, &c., for ascertaining whether suitable stone was not to be obtained on Bolsover Moor. Such measures may have been taken—I only mention this as one of the points which require clearing up for the sake of satisfying the public.

The most important question, however, after all, is, whether the stone now using is of suitable quality. On this question I am not capable of giving an opinion, but will state a few points which have struck me on an examination of the different varieties of stone, with a view to call forth the remarks of more competent judges.

1. The stone from Mansfield-wood House is not, as has been stated, *exactly* like the Bolsover. It very strongly resembles it, but differs in having a browner and less brilliant colour, and in having a far greater proportion of black metallic specks, which in some blocks are minute and clearly defined, in others large and diffused. This difference appears to be a great cause of the difference of colour which is observed among the blocks. On the whole, I think the Mansfield-wood House a darker coloured and less beautiful stone than the Bolsover, but still a very beautiful stone.

2. The question may be asked, what proof have we of the durability of this stone? In answer to this, I think it may be safely said, that there is every reason to believe that the stone used in the Norman parts of Southwell Minster, and which was supposed to be the Bolsover stone, was, in fact, procured from Mansfield-wood House. A comparison of the stone from the two quarries with that at Southwell would, I think, satisfy any careful observer on this head.

3. The Anston stone does not appear equal to either the Mansfield-wood House or the Bolsover, but is still a good and probably a very durable stone.

4. The Steetley appears to be a very friable stone, certainly semi-crystalline, but the crystals detached and ill-cemented. It is, I believe, only used internally, but I much wonder that the infinitely more beautiful stone of Roche Abbey, which is so eminently suited to internal work, was not preferred.

What your correspondent can have discovered in Mr. Bald's very interesting papers, to confirm so decidedly the superiority of the Irish limestones, I am at a loss to discover. Mr. Bald's papers only treat of the white limestone of Antrim, which no one even dreamed of recommending for the Houses of Parliament, and which Mr. Bald says should never be used for any buildings where durability is an object. Your correspondent is, perhaps, not aware that Dr. Smith, of whom Mr. Bald speaks with veneration as the father of English geology, and who, he says, has carefully examined the Antrim limestone, is himself one of the Commissioners who have been so much vilified.

I have the honour to be, Sir,
Your most obedient servant,
ANOTHER LOVER OF FAIR PLAY.

London,
September 3rd, 1840.

P.S.—It is a question worthy of being investigated, whether magnesian limestones have not a tendency to acquire a dark and gloomy colour by age. The old churches and other buildings on that formation have certainly a gloomy appearance compared with those in some parts of Northamptonshire and Lincolnshire, which are of oolite. May it not be the case that the lichens which grow on the magnesian limestone are of a dark disagreeable colour, while those which thrive on the oolites are of a white livelier hue? This is rather an important question.

ON FIRING BLASTS UNDER WATER.

MR. EDITOR,—It occurs to me that a much more simple, and much more efficient method for firing blasts under water, may be obtained, than the method used to break up the Royal George, and a method so simple that it would not require a colonel to superintend. A percussion cap is all that is necessary to fire 10,000 lb. of powder as easily as an ounce. Suppose that an air-tight compartment at the top of the powder cylinder, to be fitted up with an apparatus similar to the lock of a gun, and a strong spring carrying 4 or 5 hammers, to strike as many caps. The cock to set the spring being ground into the side of the box, and fitted with a leather collar; the trigger should also pass into the box in a similar manner. What would be more easily for the diver after having secured the cylinder strongly to its place, than to raise the spring and fasten a strong line to the trigger; the line might be of any length, and when strongly pulled would as effectually fire the blast as a dozen batteries. The caps being inside the air-tight box would be protected from the water and kept dry.

Mines might thus be fired at the exact instant when they would do the greatest mischief to the enemy.

It is a fact well known to engineers and miners, that when it is desirous to detach a large mass of rock by means of several blasts, a great part of the effect is lost by not being able to explode them at the same instant; but by means of percussion caps a hundred blasts might be fired at the same instant, a very simple arrangement would be sufficient for this purpose.

Would not cannon be also very easily fired by large percussion caps, and struck by a small hammer held in the hand of the person appointed to discharge the gun?

Those lucifer matches which explode by friction I have used without failure to fire trains of gunpowder, by merely placing two or three in the slit end of a stick (kept down by a large stone), which on being bent sideways and detained in that position by another stick, to which a long line is fastened, on pulling the line the latter stick is withdrawn, and the first carrying the matches, springs straight, the matches scrubbing on the ground or dry stone, explode, and fire the train.

Should you think these desultory remarks worth a place in your Journal, you will oblige,

Your's, respectfully,
C. L. DRESSER.

Commercial Buildings, Leeds, Sept. 4, 1840.

FELLING TIMBER.

SIR—Should the enclosed be of sufficient value in your estimation, to entitle it to a place in the Journal, it is at your service. I cut it out of the "New York Albion" a few years ago, while residing in America. The subject of felling timber is of more consequence to engineers and architects than many of them have supposed, as few would feel desirous of knowing that their labours are not destined in many instances to endure longer than the brief period of their own life, should the dry-rot allow it even that extent of duration.

I was told by a very skilful mechanic in the city of Philadelphia, that he had observed in his own experience that timber cut in the winter was invariably more thoroughly impregnated with sap than at any other time. That as soon as the new wood was at its full growth, say in August, he had found was the best time for felling the timber.

- I have myself seen thousands of trees lying in the woods of America, in the state denominated "logged," (that is cut into lengths for the mills) which, were rapidly hastening to decay, and in almost all these cases it was owing to their having been cut in the winter, as there all the logs are left after being cut, till they are needed for the mill, and many are so left for months, nor is it uncommon to see timber under the saw, of which at least one-third is at the time in a state of absolute decay.

Your's, very respectfully,

J. HOLDEN.

36, *All Saints Place, Ormond Street, Manchester,*
August 22, 1840.

"Mr. Rainey, of Middletown, Conn., a ship-builder of considerable experience, having become convinced that the sap was the cause of the decay of wood, instituted a series of experiments to ascertain its place in different seasons of the year, and found that in the winter, the heart wood contained much more than the sap wood, while in the summer it seemed concentrated in the alburnum or outside layers of wood. It has been generally supposed that the sap of the tree was principally in the roots during the winter, and acting on this supposition, Mr. Rainey had preferred for ship building, timber cut in the winter; some cases, however, in which timber cut in the summer was used with that cut in the winter, and remained sound while the latter decayed, induced an investigation as to the cause, and resulted as stated. Mr. R. now uses timber cut as far from December as possible, and finds much less cause for complaint than formerly. The following was one of the experiments that led Mr. R. to doubt the propriety of cutting timber in winter:—

"'Having cut a small oak staddle, on or about the 20th of June, I placed several pieces of it in the fire place, and put a fire under them; after a little while there appeared at the end of the sticks a wet circle describing the exact thickness of the alburnum, or sap wood, and when they became considerably heated, the steam rushed with violence from the tubes of the sap wood, while there was but a small appearance of vapour from the heart wood. About the same day of December, of the same year, I had another small oak cut, and went through with the same process of heating several pieces of the wood; and when they began to be heated, the whole surface of the heart wood, except a small circle enclosing the pith, was wet, but the alburnum was dry, and when they were fairly heated through, the steam rushed with violence from the heart wood, though the whole quantity that escaped, was not so large as in the former case. The results of these experiments accord with a well known fact in regard to the sugar maple, namely, that no sap can be obtained from the tubes of the alburnum of the tree, and therefore they are obliged to bore a hole for the tube through the alburnum, into the heart wood before it will run.'

"Mr. Rainey's inference as to the position of the sap during the severe weather of winter, is probably correct, as we have observed many appearances that would go to confirm it; but, that at the time of making sugar, the sap is found in the heart wood of the maple, is decidedly incorrect, as every person acquainted with the manufacture well knows. In many cases in tapping the trees, the heart wood is not touched at all, and it is deemed desirable to avoid it when practicable.—The sap of the maple will not, however, flow until the temperature of the earth and air has been raised by the sun of spring, and the circulation, which is partially or totally suspended in the alburnum during the severe frosts, is restored.—The relative position of the sap is consequently changed from what it was a few weeks previous, having passed from the centre to the surface through the lateral pores, or what is called the silver grain, as well as commenced its flow upwards to the expanding leaves and branches.

"Farmers find the cutting of timber for posts and rails an important item in their profit or loss account; and if Mr. Rainey's experiments as to the duration of timber can be fully relied upon, or substantiated by further experience, a very great point in domestic farming economy would be gained. We think the early settlers of Western New York could throw much light on this subject, by ascertaining the relative duration of their rail fences made from timber cut in the winter, or midsummer, as most farms must have had specimens of both kinds; and any notices of this nature, furnished us, shall be inserted with pleasure."

TIDE GAUGE.

SIR—My attention was directed by a friend, who is a Civil Engineer, to a paragraph in "The Civil Engineer and Architect's Journal," for May 1838, under the head of "Proceedings of Scientific Societies," Royal Society, giving a description of a new Tide Gauge, constructed by T. G. Bunt, and erected on the eastern bank of the river Avon, in front of the Hotwell House, Bristol, in 1837. At this I was astonished, as I was on a visit at Mr. Mitchell's, at Sheerness Dock-yard, three or four years since, when Mr. T. G. Bunt was carrying on a *self-established* correspondence with Mr. Mitchell, *who was a stranger to him*, and Mr. Mitchell, to my knowledge, actually sent him a drawing of his tide gauge with a description, which so *singularly* and *so nicely agrees* with that given by Mr. Bunt of his *new tide gauge*; and Mr. M. showed me at the time, some of the letters that he had received from Mr. Bunt, which had they come to me from a stranger as they did Mr. Mitchell, I should have thought it great impudence. I have since shown this paragraph to Mr. Mitchell, who, like the immortal Watt, with "dirty" Prony, was too inoffensive a man to attack the person when the injustice done was mentioned to him. I have since this again asked Mr. Mitchell if he had known Mr. Bunt before? He replied, no; nor have I ever seen him. I asked Mr. M. why he ever answered the first letter? He said (and should this meet his Mr. M.'s eye, I hope he will forgive me publishing private conversation), "why, really I thought the person Mr. Bunt, might have a family like myself, and might be striving to gain something by working out his own ideas, at seeing mine in its complete state, but I had no idea of such as you have shown me."

Mr. M. then again showed me his "tide gauge," which as aforesaid, was erected in all her Majesty's Dock-yards, and has answered admirably for years; he also showed me that of Mr. Lloyds, which is quite different.

A description of Mr. Mitchell's tide gauge may be seen in the "Nautical Magazine," for one of the months in the year, I think, of 1835, and which was inserted by a friend of Mr. M.'s, at *that friend's very kind request.*

Now these facts, for the good of the community at large, especially the various scientific gentlemen that read your Journal, whose protection is of importance, I lay at your disposal, and as it is the duty of every person to crush "plagiarism," I have forwarded this, which I would thank you to give insertion in your valuable scientific and interesting Journal, as a "beacon" to warn persons from being unexpectedly similar passive objects.

I am, Sir, your obedient servant,

JAMES INGLIS.

London, Sept. 2, 1840.

P.S.—Since writing the foregoing, I have seen Mr. Mitchell's son who made the drawings and wrote the description that was sent to Mr. Bunt of Mr. Mitchell's tide gauge, who says that the correspondence could doubtless be produced.

[We have omitted the first part of Mr. Inglis's communication, as it only relates to the invention of a tide gauge which has failed, there is no charge of plagiarism against the party.—EDITOR.]

YSTALYFERA ANTHRACITE IRON.

Mr. Evans, of Manchester, has given a report upon the *strength* of the Ystalyfera Anthracite Pig Iron, of the several qualities, Nos. 1, 2, and 3, with a view to ascertain its properties, particularly in relation to other irons, being the result of about 280 experiments upon rectangular transverse bars. The experiments were made by breaking the bars between supports of their distances; namely, of 4 ft. 6 in. and 2 ft. 3 in. apart.

The trials were confined to the transverse strength of 1-inch rectangular bars, with their several values, as under:—

1st. Specific gravity.—2nd. Modulus of elasticity.—3rd. Transverse strength of 1-inch rectangular bars, 4 ft. 6 in. apart.—4th. Transverse strength of 1-inch rectangular bars, 2 ft. 3 in. apart.*—5th. Ultimate deflections.—6th. Power to resist impact, of which the tables† are divided into, and contain bars broken from

72 specimens of No. 1,
65 ditto of No. 2.
61 ditto of No. 3,

all cast horizontally in stand, melted by coke from the cupola in the usual way;—

44 specimens of bars melted as above, of equal mixtures of Nos. 1, 2, & 3;—

24 specimens ditto, of the same melting and mixture, but afterwards planed down to a perfect 1-inch square gauge; and—

16 specimens ditto, of the same mixture, but melted in the crucible.

The area of breaking section is calculated as the square of the depth, into the breadth, and inversely as the length; an example of which is subjoined, for the bars requiring reduction to 1·00 inch square from excess of area at the fracture or otherwise: thus, No. 12 measured, depth 1·002, breadth 1·005, which, reduced, stands 499 5 lb. in the table, under the head of 4 ft. 6 in. bars.

RULE.—To find from the above table the breaking weight in rectangular bars, calling b and d the breadth and depth in inches, and l the distance between the supports in feet, and putting 4·5 for 4 ft. 6 in., we have $\frac{4{\cdot}5 + b\,d^2\,S}{l}$ = breaking weights in lbs.—The value of S being taken from the above tables.

For example: What weight would be necessary to break the bar, No. 21, in No. 1 table, 2 inches broad, 3 inches deep, and 6 feet between the supports? According to the rule given above, we have $b = 2$ inches, $d = 3$ inches, $l = 6$ feet, $S = 484$ from the table. Then $\frac{4{\cdot}5 \times b\,d^2\,S}{l} = \frac{4{\cdot}5 \times 2 \times 3^2 \times 484}{6} =$ 6534 lb.‡

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* The 2 ft. 3 in. bars are reduced to 4 ft. 6 in., as being a fair method of obtaining a more correct mean; a separate column in the tabulated form being set apart for them.

† The report contains six tables of experiments made by Mr. Evans, we have given the table only containing the *mean* result of all the experiments.—[Ed.]

‡ The modulus of elasticity is taken from the deflection caused by 112 lb. on the 4 ft. 6 in. bars.

Elasticity calculated from the deflection caused by 112 lb. on inch square

We will briefly take the mean values of each table, together with a summary of comparison of the whole, &c. §*The specific gravity* of No. 1 Iron at 7·093, is rather under the standard 7·207, as given by Tredgold, but above the mean of the No. 1 in Messrs. Fairbairn and Hodgkinson's list, which give 7·032 for twelve different irons of this number. As Tredgold's is a *general* one, and not the result of any particular number; and as it will be found in Anthracite Iron, as well as in Messrs. F. and H.'s results, that the No. 1 is usually a lighter iron than either of the Nos., the above may be considered a near approximation to the usual irons of the same No. or quality made from coke.

Its modulus of elasticity, the mean of which is 13970644 shows the comparative stiffness of the metal, and is given in pounds per square inch.

The *breaking weights* are given in three separate tables, the mean of which makes 444 lb., 445 lb., and 444·5 lb. respectively, which approximate in rather a singular manner to each other, and must be taken as the best proof of *uniformity* of *strength* and texture of this number, the value of which, as compared with other irons, stand as under :—

Mean of 72 results upon the Ystalyfera Anthracite Iron, No. 1 444 lb.

Mean ditto of 10 different sorts of No. 1, in Messrs. Fairbairn and Hodgkinson's list . . . . . . 430 lb.

being a superior strength in favour of the Anthracite Iron of about 3¼ per cent. I regret that most of the other authorities give the breaking of 1-inch bars on a very limited scale, in few instances distinguishing the different *Nos.* they were made from, and broken between distances of every variety, which is an additional objection to my offering them in the above comparison; but in a summary of a few that I found more easy to reduce, they form rather an inferior value to Messrs. Fairbairn and Hodgkinson's irons.

The following table comprises a summary of the whole of the experiments made by Mr. Evans, together with the same from Messrs. Fairbairn and Hodgkinson's list :—

Summary and Comparison of the Total Mean Results from each of the Tables, together with the same from Messrs. Fairbairn and Hodgkinson's List.

Number of experiments 4 ft. 6 in. between supports, and 2 ft. 3 in. bars, reduced to 4 ft. 6 in.	Specific gravity.	Modulus of elasticity in lb. per square inch, or stiffness.	Breaking weight in lbs. of bars, 4 ft. 6 in. between supports.	Breaking weight in lbs. of bars, 2 ft. 3 in. reduced to 4 ft. 6 in.	Mean breaking weight in lbs. (S.)	Ultimate deflection of 4 ft. 6 in. bars, in parts of an inch.	Power of the 4 ft. 6 in. bars to resist impact.
Mean of 72 on No. 1	7·093	13970644	444	445	444·5	1·843	821
Ditto of 65 on No. 2	7·120	14544293	494	499	496	1·632	811
Ditto of 61 on No. 3	7·130	16622197	531	537	533	1·640	916
Ditto of 41 on equal mixtures of Nos. 1, 2, & 3	7·110	15200982	465	479	471	1·553	749·7
Ditto of the same from the crucible, No. 16..	7·190	14894800	551	597	574	1·625	901·2
Ditto of 24 of equal mixtures as the 41, but planed	7·110	14676771	533	539	536	2·447	1313·1
Forty-seven Specimens from Messrs. Fairbairn and Hodgkinson's Tables of Nos. 1, 2, and 3, as under :—							
No. 1. 10..............................	7·032	14132994	433	428	430	1·597	694
No. 2. 25..............................	7·029	14570118	435	443	439	1·626	711
No. 3. 12..............................	7·122	17683712	478	487	483	1·374	685
Summary of the Mean of the 198 Results of the 3 Qualities of Anthracite, and the 47 from Messrs. Fairbairn and Hodgkinson's List.							
198	7·114	15045711	489	493	491	1·703	849
47	7·060	15462274	448	542	450	1·532	696

In making a comparison of the same numbers of the Anthracite Iron, and those which are comprised in the latter 47 results, the three first of the six only, contained in the preceding table, must be taken, the other specimens being on iron, under other conditions, containing the mixed, planed, and crucible results, &c., a final mean of which may be taken as above :—

Which taken singly, or collectively, show a superior value in every column in favour of Anthracite Iron as compared with the most numerous list of other makes; and it would appear that the No. 1 is the most uniform in texture, strength, &c., having the greatest fluidity, softest, and lowest specific gravity, and for its strength, which is the weakest, is most to be relied upon, as far as it extends.

The No. 2, less uniform a little in texture, and strength, fluidity, &c., but of higher specific gravity, and stronger than No. 1.

The No. 3 still less to be depended upon in the above qualities, but of increased specific gravity and strength to the No. 2.

The equal mixtures show a deterioration of the several Nos., compared to their values separately, and the same as regards specific gravity. The same, but cast from a crucible, exhibit an improved list of values, including a greater specific gravity.

The planed bars show an increased strength above the same metal in the black bar: this is the only specimen whose strength is increased, without the specific gravity being greater also, which must be due to the planing, and not any alteration of metal, &c.

It may be inferred from the whole of the tables, except the last, and the higher specific gravity exhibited by the Iron, the greater the strength.

IMPROVEMENT OF LOUGH ERNE, IRELAND.

Report of the improvement of Lough Erne, for the purpose of rendering Navigable for Steam Vessels, and other Craft, and for keeping the Lake at a more uniform level.

The Upper Lake extends from Belturbet to Enniskillen, and can be navigated through the channels or sources; that along the eastern side is 18 miles in length, and that on the western is about 16 miles, which are described by red dotted lines on the map or chart No. 1.

The Lower Lake extends from Enniskillen to Belleek, its north western extremity, and measures about 24 miles.

The fall from the Upper Lake at Lisgoole Abbey to the Lake at Portora is only 2¼ inches. This is occasioned by the Danes Eel Weirs, the bridges at Enniskillen, and the shoal at Portora.

The Upper and Lower Lakes, considered together, present a most magnificent sheet of water, interspersed with numerous islands, which are in general highly cultivated; and for beauty and luxuriance of scenery cannot well be surpassed, and forms one of the finest lines of inland steam boat communication in the United Kingdom, creating as it does one direct line from east to west of upwards of 42 miles in extent, besides the numerous inlets to every village and farm along its coasts, which may be safely calculated at three times the above length—the whole of which may, when improved, be navigated without the interruption of a single lock or other obstruction, so that, with good steamers, the journey from Belleek to Enniskillen, Belturbet and Wattle Bridge, may be accomplished in a few hours, which at present, I am told, takes the boats, containing only a few tons of goods, upwards of a week, besides their having to be lightened at every shoal to enable them to pass.

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bars.—l = distance in inches between supports.—w = 112 lb.—c = breadth of bar.—d = depth of bar.—a = defluction caused by 112 lb.

Formula. $\frac{w\,l^3}{4\,c\,d^3\,a} = m$, or modulus of elasticity in lb. to work which logarithms had better be employed.

For the above formula, see Messrs. Fairbairn and Hodgkinson's report, Tredgold, &c.

§ "The precise determination of the maximum and minimum specific gravity of cast-iron is of importance to the Founder and Engineer as giving the data upon which the weight of castings are estimated, and which, as stated by authors, are an unsafe guide, inasmuch as the specific gravity of cast-iron varies with its composition,—the way in which it is cast, the rate of its cooling, and the depth of the mould, to an extent not generally considered; hence the different specific gravities of bars cast *vertical*, and those cast *horizontally*."—*Mallet on Iron*. See 7th Report of British Association.

The Upper Lough may be termed a series or chain of lakes, branching and ramifying its course along the vallies of the country, forming numerous inlets, which are sufficiently deep at the lowest water to navigate vessels of considerable burthen, and which afford a ready means of transit for merchandize, and the produce of the country, in every direction, particularly to Belturbet, Enniskillen, and Belleek, which latter place is situated on the Lower Lake, and is only three miles distant from the seaport town of Ballyshannon.

Near Wattle Bridge, on the eastern side of the Lough, the Ulster Canal enters, which I expect will be opened in the course of a few months. This canal will form one of the grand outlets for the produce of this finely cultivated country to Belfast, Newry, &c., it being at present shut out completely from competition in these markets, on account of the want of a ready and cheap conveyance by water; and when such great facilities for intercourse and trade present themselves, and requiring comparatively so small a sum for accomplishing such a desirable object, it appears somewhat extraordinery that the improvement of the navigation of this fine sheet of water should have been so long deferred.

The several shoals, eel weirs, and other impediments to the navigation, besides causing the before-mentioned disadvantages, also act as dams across the channel, and retard the natural and regular flow of the water, which is backed up to an incalculable extent, and thrown over the low lands along the different vallies bordering on the lakes, submerging and inundating for several months of the year, from 20,000 to 30,000 acres of the finest land in the country, which, if the water could be taken off, might be brought under the most perfect state of cultivation.

I found, from observations and levels taken on the spot, that the difference of level between the winter floods in January last, and the summer water in May, at the undermentioned points, was as follows, viz.

Belturbet and Wattle Bridge..................	9 ft.	0 inches.
Enniskillen..................................	7	10
Belleek	4	0

and the surface of the water, between these points, forms nearly an inclined plane. The least or smallest rise is at Belleek, which is owing to the Lower Lake being of so much greater extent than the Upper one, and acting as a compensation reservoir, and allowing the water to escape more uniformly.

Having given a general description of the lake, I will now enter more into detail, and describe the impediments which exist in the narrow parts of the river, their effects, and what alterations are necessary to improve the navigation and drainage of the country from Belleek to Belturbet, and having been supplied, as I before mentioned, with the very accurate charts published by order of the Admiralty, which point out distinctly the deep and shallow parts of the lake; it became, therefore, unnecessary for me to take the soundings of the whole extent of the lakes, my principal duty was to investigate the shoals and impediments existing at the following places and points, viz.

1st. From Belleek to Roscor.
2nd. Portora.
3rd. The two channels and bridges at Enniskillen.
4th. Dane's Eel Weirs.
5th. Carry Bridge.
6th. Black Rock, and some small ridges of gravel, on the south west passage near Crom Castle.
7th. Blockson Shoal, which is within two miles of Belturbet, and composed of solid limestone rock.

Accurate soundings were taken at the above places, and plans, longitudinal and transverse sections have been prepared which I now forward, showing the depth of water, with the line of proposed deepening for improving the navigation and drainage.

The soundings and other observations were taken at a very favourable time, viz., the latter end of last April and the beginning of May, when the season was remarkably fine and dry; so much so that the water was within six inches of the lowest point ever remembered by the oldest inhabitant residing on the Lake—the floods during the previous winter season being the highest ever recollected.

The above being the case, I was afforded a good opportunity of judging of the effects likely to be produced by "reducing the waters to a uniform level."

The datum or surface of water shown on the sections, is supposed to be nine feet eight inches under the lower edge of the string-course at the springing of the abutment arch, S. W. angle of the West bridge at Enniskillen.

At this level, the water being very tranquil, and with scarcely any perceptible current, I found, by taking accurate levels of the shoals at Portora, Enniskillen, and Dane's Eel Weirs, that the difference of surface between the Upper and Lower Lakes, at their extreme points, only amounted to 2¼ ins.—I was gratified upon determining this fact to find there was no necessity for erecting a lock, as I had been led to suppose there was a fall of from two feet to three feet between the two lakes. This not being the case, it will simplify the works required to be done, both in the execution and the expenditure.

The bridge of Belleek is of old construction, and appears in a very dilapidated state. It is built with rubble masonry, and composed of four arches of the following dimensions, viz.—35 feet, 19 feet 4 inches, 20 feet, and 7 feet 6 inches span. It rests on a solid rock of limestone; the water in the river flows through the large arch, under which there is a deep chasm cut out of the rock 30 feet in depth, caused by the incessant rushing of the water from the falls above, which descend with great violence and rapidity, falling, from the surface of the water at the Eel Weir to the level below, 15 feet in the distance of 100 feet in length.

The arches are evidently too small in capacity for so great a body of water rushing down during the floods, at which times it shakes the bridge very much, making it appear in danger of being carried away.

I would recommend a new bridge being built at this place, in a more direct line with the entrance of the town, with stone piers and abutments, and a cast-iron arch of 100 feet span, with two side arches of stone, 30 feet span each.

The Eel Weirs at the top of the fall are a great obstruction to the free passage of the water, being built of stone, and forming solid walls about 4 feet 6 inches high, and 4 feet broad at the base, by which means two-thirds of the distance across the river is blocked up. These walls or weirs should be cleared entirely away, and a wall erected about five or six inches below the summer level, and 1,100 feet in length, according to the form described on the drawings. The proposed site is a very favourable one for the purpose, being of solid limestone rock—the surface will require very little levelling or preparing, and upon an average one course of stone will be sufficient to build the Dam from one end to another; for this purpose and also for building the proposed bridge there is abundance of flat bedded stone on the spot.

The falls of water at this place are remarkably fine and well worth attention, as they present several such sites for mill power as are rarely to be met with.

The old corn mill at the end of the bridge, which is now working to great disadvantage, will require to be removed (to make way for the proposed weir) to a far better site to be selected.

The three channels of the river course leading to the dam will require to be deepened from one foot six inches to two feet, which can easily be effected, to allow the water to flow freely to the dam; also the point of rock below the line of the proposed dam should be taken off to allow the water to escape to the chasm below. Above the dam there are several good sites for landing places and quays for Steam Packets and Trade Boats.

The channel of the river from Belleek to Roscor, entering the lake is fine, and strait, and of sufficient width. There are several shoals which are composed of gravel and clay, besides the Carry Eel Weir, which is similar to the one at Belleek, (formed of stone) and dams up the water in a much greater degree, causing a head of from one foot six inches to two feet during the floods.

The above shoals and Eel Weirs require to be removed to the breadth and depth shown on the plans and sections, viz., 200 feet wide, and seven feet deep.

The shoal at Portora is formed of gravel and clay, and will require to be deepened as shown on the plan and section.

The West bridge at Enniskillen is of recent construction, and built of rubble masonry, ashlar quoins and arch stones, string courses and parapet for fixing the railing; it has three arches of 45 feet 6 inches span each; segments of circles rise 15 feet 6 inches, and 19 feet 6 inches in height from the surface of water to soffit of arches; piers are 11 feet thick. I was informed by Mr. Maguire, the builder, that the west abutment is sunk 6 feet under the bed of the river, and the other abutment and the two piers 3 feet. The water-way under the arches is very shallow, and the piers and east abutment would require under-pinning, as shown in the elevation; and the channel both above and below the bridge, as well as under it, requires deepening from opposite the Castle to the deep water near the Distilleries below the bridge.

There are several encroachments on the river at this place, in the shape of walls and quays, which should be taken down, so as to give the river its original sectional area.

The East bridge is an old structure and built of rubble masonry, it is composed of five arches of the following dimensions, viz., 22 feet 3 inches; 24 feet; 23 feet; 26 feet; and 21 feet span, and from the surface of the water to the soffit of the arches is 17 feet in height. At this time nearly all the arches were dry, with the exception of one of them, through which small boats might pass. I would recommend the bed of the river under the arches to be deepened and the piers under-pinned.

There are several shoals in the river in the East Channel, which require deepening, particularly at Boston's Ford.

The Eel Weirs at Dane's Weirs appear very formidable erections which almost choke up the channel of the river, merely leaving a small space of about 20 feet in width for the boats to pass through. In other respects, also, it forms a very difficult channel for the Navigation at any time; but particularly so in the winter season; and when the head of water is great, and is necessarily attended with much danger to the boats navigating up and down stream. In summer the boats are required to be lightened, in order that they may be enabled to pass over the shoal. The Eel Weirs are constructed according to the form represented on the plan, and composed of piles, stakes, &c., and made to close with wattles, &c., that few fish can pass through the eyes or gaps. The bed of the river where the Weirs are erected is very shallow, and is composed of clay and gravel.

The banks of the river at this place are high and slope towards the river's edge.

This shoal and Eel Weir, and the shoal and contraction of the Bridges at Enniskillen, are the principal obstructions in this quarter, and which cause the lands and property on the Upper Lake to be inundated to a great extent—these Eel Weirs to be cleared away, and the shoal deepened.

In case the Weirs cannot be purchased for a reasonable sum, I would propose making a cut across the bed of the river near Lisgoole Abbey. The line I have selected is very favourable for this purpose; it would lessen the distance considerably, and might be done for a comparatively small sum. At the same time I would prefer keeping by the river channel, although the distance is greater; still it would be easier accomplished and would keep the channel wider, so as to give every facility to the Drainage and Navigation.

The channel of the river from Dane's Weirs to Carry Bridge is fine and open, with the exception of a few small ridges or shoals of gravel, which can be cleared away in the course of a week, with a good Dredging Machine.

Carry Bridge forms a great obstruction to the navigation and drainage; in fact it can scarcely be called a bridge, as the opening is but 12 feet wide, and 10 feet high, the remaining part being a long wall forming the roadway to the island of Inishmore. In flood time this obstruction creates two feet head of water, and nearly stops the passage of the water; so that although this channel is the finest no boats are able to pass. This erection requires to be entirely cleared away, and the channel deepened according to the section; and instead of the present bridge, I propose that a new bridge be erected of three arches, each 40 feet span, the two side ones to be fixed stone arches, and the centre one of cast iron, in two parts, so as to allow steamers and masted vessels to pass at all times without lowering their chimneys or masts.

Proceeding along the western channel, the Black Rock is the next obstruction to be met with, upon entering the narrow channel, which is from 70 to 80 feet in width. There are a considerable number of large detached pieces of rocks in the sides and bottom of the river, which in summer have only about two feet water upon them, which can easily be cleared away either by blasting or lifting them out of the river with proper tackle.

There are two or three smaller ridges or shoals above this in the western channel, which are composed of clay and gravel, and which ought to be removed to the depth of 7 feet from summer water, and to the width of 100 feet, which can be easily done by the Dredging Machine.

At the ferry at Inishmore there is a fine site for a suspension bridge, which might be elevated sufficiently so as to allow masted vessels to pass. It would also be of great convenience to the county.

Above Crom Castle there are two shoals or ridges, also near Wattle Bridge, which are composed of gravel and clay, and easily removed at a small expense.

Blockson's Ford is of solid limestone rock; this shoal is a great obstruction to the free discharge of the water, and ought to be removed. This part is the most difficult to be remedied, and will require a Coffre Dam, so as to clear one-half of the river, first by blasting and removing the rock, and when this is accomplished, to remove the Coffre Dam to the other parts of the river, and clear it in like manner.

I have carefully prepared Estimates of the before-mentioned works, and find that the whole may be executed in a workman-like manner, for the sum of £29,797.

In conclusion, I beg to remark that I am not aware of any work or project whatever, where so much benefit might be derived at so small a cost, both on account of the Drainage and Navigation, and when it is considered that the Ulster Canal is now on the eve of completion, which connects the port of Belfast with Lough Erne; and the possibility of the projected Junction Canal, which will join Lough Erne with the river Shannon, being carried into execution, it will form a communication from the Atlantic Ocean to St. George's Channel, and as it is a work similar to the Shannon, and next to it in importance, it well deserves the consideration of the Legislature, so as to put it in every respect upon the same footing with that great national undertaking.

Trusting the foregoing Report may meet with your approbation, and the Gentlemen connected therewith, I have the honour to be, Sir,

Your most obedient and humble servant,

THOMAS RHODES.

ESTIMATE of the cost of the proposed works for the improvement of the navigation and drainage of Lough Erne, to accompany Mr. Rhodes's report, dated 13th July, 1840.

New Bridge at Belleek	£8,000	0	0
Dredging the bed of the river from Belleek to Roscor, including the clearing away of the Eel Weirs and the masonry of the proposed Weir	9,147	4	6
Dredging the bed of the river at Portora	784	14	6
Dredging both channels of the river at Enniskillen, and underpinning the piers of the bridges	1,860	19	6
Clearing away Dane's Eel Weirs, and dredging the bed of the river	2,250	0	0
Dredging the bed of the river at Black Rock	150	0	0
Excavating the channel of the river at Carry Bridge, and building a new bridge there, as shown on the plan	6,000	0	0
Excavating and blasting the rock at Blockson's Ford, and other small fords and shoals	1,604	2	6
Total amount	£29,797	1	0
N.B.—If the river course be abandoned at Dane's Weirs, and a cut made across the low lands near Lisgoole Abbey, a further sum must be added of the amount of	3,516	13	0
	£33,313	14	0

THOMAS RHODES.

In the above calculation no allowance has been made for the purchase of Eel Weirs.

FALL OF A SUSPENSION BRIDGE IN INDIA.

It is with feelings of much regret that we announce a lamentable accident which has just occurred at Madras, attended with great personal injury to many unfortunate individuals, though, as yet, so far as we have heard, with but one loss of life. On Monday afternoon the 33rd Regiment of Native Infantry (or certain companies of that corps) were crossing the Suspension-bridge at Chintandripett, on their way to escort His Highness the Nabob, and take part in the customary procession to his father's tomb, when one of the great suspension chains at the eastern end of the bridge gave way, precipitating the roadway and the concourse of persons then upon it (about a company and a half of sepoys) into the stream below. The crash must have been tremendous, and great personal injury sustained by many. We hear that 1 Subadar, 4 Havildars, and 26 men were severely hurt and bruised, and several more slightly injured; indeed, had not the elevation of the bridge above the water been so small, and the water itself so shallow, the accident would have been attended with great loss of life. The part of the bridge which gave way was the links of the eastern suspension chain, where they pass over the friction roller of the north-eastern pier. Two of the three links have snapped across, and on examining the fracture it is evident that both, but one more especially, has for a long time been in a defective state, having a crack extending almost through it. Indeed, it seems to us that the bridge has, at some former period, experienced a powerful strain, which had partially cracked these links, weakening them so far, that the pressure of the crowd at once tore away the remaining fibres, and occasioned the whole fabric to give way. It is a fact of some importance, and one perhaps not very generally known, that a concourse of people is one of the greatest loads which can be imposed upon any structure, since it brings a vast weight within a narrow compass, and that the strain is especially severe in the case of a body of military marching in regular order. We may here observe that one of the few occasions on which we have known an English suspension-bridge to fail was about ten years ago at Morpeth, in Northumberland, when exposed to a somewhat similar strain to the one in question, being crowded by persons returuing from a fair. On two other occasions, where suspension-bridges at home have given way, it has been during the passage of troops in a regular march over them,—we allude to the bridges at Broughton and Montrose. The severe strain or vibration occasioned by the measured tread of a body of military is indeed so trying to these structures, that it is considered by engineers that they will in this case bear but one-eighth part of the weight they might be otherwise safely loaded with.—*Madras paper*.

ERECTION OF A SAFETY BEACON ON GOODWIN SANDS.

The task undertaken by Captain Bullock, of Her Majesty's steamer Boxer, of erecting a safety beacon on the Goodwin Sands, about seven miles from the town of Deal, has been successfully accomplished, by which it is hoped to avert the dreadful loss of life by shipwreck which has so frequently occurred in that part of the British Channel. To the high credit of Captain Bullock this desirable object was accomplished on Thursday, 10th ult., under his superintendence and that of Captain Boys, superintendent of the naval store deparment of Deal. Captain Bullock has been long engaged in carrying out the above object, and in the arduous duty of correcting the charts in various parts of the globe, and is now doing so under the authority of Government in the waters of England. He commenced at Westminster Bridge, and proceeded towards the Land's End, which is at present undergoing his survey. The beacon he has succeeded in erecting consists of a column about 40 feet above the level of the sea, having cleets and ropes attached to four of its sides, with holds for hands and feet. At the summit of the column is attached a gallery of hexagon form, made of trellis work, and capable of holding 20 persons at one time. Above the gallery, and in continuation of the column, is a flagstaff 10 feet long, thus making the entire beacon 50 feet in height. The sides of the gallery are so constructed as to enable the persons in it to be covered in with sailcloth, which is reefed in and round it, and can be used at pleasure; as also an awning to pass over it, which is fixed to the flagstaff; thus entirely protecting any unfortunate mariner who may seek shelter on the column from foul and tempestuous weather. A barrel of fresh water, together with a painted bag enclosing a flag of distress, is stationed on the gallery, and the words "hoist the flag" painted in the languages of all nations on bosrds stationed round the inner part of the gallery, so that the foreigner as well as native seaman may be enabled to show a signal of distress, and obtain help from shore, which is about seven miles distant from the beacon. The means by which the beacon has been erected in so extraordinary a place as the Goodwin Sands are as follow:—the foundation of the column is several feet below the surface of the sand, and is secured in the centre of a stout oak platform, extending from it on either side several yards. This is secured by upwards of two tons of pig-iron ballast being lashed to it. In addition to this, eight stout iron bars, each six feet long, are driven obliquely on each quarter of the column, and two also put at a distance of 12 feet on each quarter, and chains attached to them, communicating with the upper part of the column and the gallery. The sands for three or four hours during the tides are high and dry, and present a fine tract of level extending for several miles. Great numbers of visitors from Ramsgate and Deal attended the erection of this tribute to humanity. The first person to mount it was Lieutenant G. C. Boyes, a young and intrepid officer, who, on reaching the summit, hoisted his handkerchief, a fac simile to a union jack. The indefatigable exertions of Captain Bullock, Captain Boyes, Lieutenants Gull and Bowes, and the other officers and men engaged in the undertaking are deserving of the highest praise, they being compelled to work for several hours up to their knees in water. Several visitors afterwards ascended the column, and testified, in the strongest terms, their approbation of this stupendous work for the benefit of humanity.—*Times.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

March 31.—The President in the Chair.

The following were balloted for and elected:—John Brannis Birch, Charles Denroche, John William Power, Henry Rawnsley, and George Dobson, as Graduates.

"*On reclaiming Land from the Sea, with Plans illustrative of Works in Loughs Swilly and Foyle.*" By J. W. Bazalgette, Grad. Inst. C.E.

The art of reclaiming land from the sea has been practised from a very remote period. Among the instances best known to us are Romney Marsh, in Kent; the Foss Dyke, in Lincolnshire; and the coasts of Holland and Flanders. The extreme fertility consequent on such reclamations has caused many attempts to be made, and nearly all have been successful; but none presents a greater prospect of success than that about to be undertaken under the direction of Mr. Macneil on the borders of Loughs Swilly and Foyle, in the counties of Donegal and Derry.

Lough Foyle communicates with the Irish Channel by a narrow inlet, above which it spreads over a wide tract of land, and then, suddenly contracting, joins the river Foyle about four and a half miles below Londonderry, up to which city it is navigable for vessels of 500 or 600 tons burden. The rush of the tide through such a small inlet has carried with it great quantities of alluvial soil, which it has gradually deposited on the side of the lough, and thus formed a bank which extends four or five miles in length, and is only covered by the tide at high water. In order to reclaim this tract of valuable land, of about 25,000 acres, it is proposed to construct, somewhat below low water, an embankment or sea wall, of about 14 miles in length. The tide never rises here above 12 feet, nor is there ever any swell in the lough to endanger the structure.

Lough Swilly is wider at the mouth which opens into the Western Ocean, and is consequently more subject to the effect of wind than Lough Foyle. The highest tides rise about 18 feet. Several embankments are proposed, which will reclaim altogether about 2000 acres of land; a tract already reclaimed, which is considered to be of the best quality in the country, lets at 5*l.* per acre. The measurements and soundings to ascertain the best position and requisite depths of the embankments were thus taken. A tide gauge was permanently fixed on which the range of high and low water was marked; a constant register was kept of the soundings, and the time at which they were made; these were afterwards reduced to the high and low water of any one tide. The distances were determined at the same time, by means of a pocket sextant from the boat, angles being taken between certain fixed objects on the shore, so that the exact soundings could be ascertained and laid down with great accuracy. The slopes of the faces of the embankments vary on the sea face from three or four to one, and two to one on the land side. Each has a culvert 4 feet diameter, with sluices and flood-gates, founded upon piling with tie beams, and the spaces filled with concrete, the whole being covered with planking. The gates are at the lowest level of spring tides, so as to allow of the greatest degree of drainage. The wing walls of squared rubble stone stretching on either side of the gates are founded also on a bed of concrete, 4 feet wide by 2 feet deep. These gates are to be used either to keep back the fresh water for the purposes of irrigation, or for scouring away the silt which would accumulate externally in front of them. A bed of puddle, 4 feet 6 inches wide at the bottom and 3 feet wide on the top, extends longitudinally throughout the embankments. The land water is carried away by a series of catchwater drains, which extend around the reclaimed lands at the level of high water, having sufficient fall to secure its drainage through the sluices. These drains are puddled, and have their internal faces covered with sods, at an inclination of two to one.

As there are many situations where stone is very scarce, and where timber abounds, the author has turned his attention to devising a plan of embanking applicable to such localities. It may be thus briefly described; the body of the embankment should be of clay, earth, gravel, and stones, dug from the surface and thrown up in a bank, with a slope suited to the force likely to act upon it. On the water side is placed a strong facing of fascines, 6 feet thick at the bottom and 4 feet thick at the top, embedded in the soil in an oblique direction, the dip being towards the land; they are securely fastened down by iron screws running at right angles through the whole height. The land face is covered with sods. In a country where wood abounds, this kind of embankment would be formed at a very cheap rate. In other situations, where the embankments would be subjected to greater strain, the thickness of the mass of fascines should be increased to 13 feet at the bottom and 4 feet at the top. In this case, at four feet from the front of the bottom of the slope should be placed a row of fender fascines, 3 feet wide by 2 feet high, bolted down, for the purpose not only of defending the face of the bank from the action of the sea, but for retaining all deposits left behind by it; by which means the embankment would in time acquire a natural face of soil, as is the case with some of the embankments in Holland. The average cost of this kind of embankment, including the sluices and the necessary bed of puddle in the centre, would be about 12*l.* per running yard.

This paper is accompanied by seven plans of the proposed embankments and charts of the loughs.

"*On the use of Mica, as a substitute for Glass, in the Windows of Workshops.*" By Joseph Glynn, F.R S., M. Inst. C. E., &c.

In the windows of the workshops at the Butterly Iron Works so much glass was broken by the chippings of iron, that a substitute was sought which should resist a moderate blow, and yet be translucent. A quantity of sheets of mica were procured from Calcutta, which, when fixed into the cast-iron window frames, were found to resist the blow of a chipping of iron driven off by the chisel with such force as would have shivered a pane of glass. Mica possesses both toughness and elasticity, and when a piece of iron does penetrate it, merely a hole is made large enough to allow the piece to pass, while the other parts remain uninjured. It is not quite so transparent as glass, but it is not so much less so as to be objectionable; but this circumstance is not important at Butterly, as, in consequence of the quantity of fluoric acid gas evolved from the fluate of lime used as a flux in the blast furnaces, the glass in the windows is speedily acted upon, and assumes the appearance of being ground. Mica is a little more expensive than common glass; but, as its duration promises to be much longer, it must be more economical; and if an extensive use of it could be induced, a more ready supply would be obtained—probably from Pennsylvania or from Russia, where it is commonly used for windows in farm-houses, and also on board ships of war, as it is less liable to be fractured by the concussion of the air during the discharge of heavy artillery. It can be procured of almost any dimensions necessary for ordinary purposes, as it has been found in Russia in masses of nearly 3 feet diameter. It is susceptible of very minute subdivision, as, according to Haüy, it may be divided into plates no thicker than $\frac{1}{300000}$ of an inch.

"*On a specimen of White Cedar from Bathurst, New Brunswick, sent by Mr. Churchill.*"

The specimen exhibited to the meeting was of the dimensions calculated for a railway sleeper, for which use it was proposed to introduce this timber, as it is stated to possess, in a very superior degree, the quality of durability in situations calculated to try its properties. It can be imported at about 3*s.* 9*d.* to 4*s.* per sleeper.

Mr. Hawkins observed, that he knew that species of timber well, having seen it extensively employed in the United States. It is an evergreen tree, and grows only in wet or boggy grounds, and is found most plentifully in New Jersey, Maryland, and Virginia. It attains the height of 70 to 80 feet, but is rarely more than 3 feet in diameter. The concentric circles in it are always perfectly distinct, and prove that the tree only arrives at its full growth after a long term of years—as many as 277 annular rings have been counted in a trunk 21 inches diameter, at 5 feet from the ground. The wood is light, soft, fine grained, and easily wrought. It has an aromatic odour, which it preserves as long as it is guarded from humidity. It resists alternations of dryness and moisture better than any other wood, and on this account is extensively used for shingles for roofing. They sell at Baltimore for 4 or 5 dollars per 1000. These shingles will last from 30 to 40 years. It is in great demand for household utensils, so much so that a distinct class of coopers are called cedar coopers. It is used for boat building on account of its great buoyancy. Cedar boards are sold at Philadelphia at 20 dollars per 1000 feet. White cedar rails, with red cedar posts, form the most durable kind of fence, being known to have lasted from 50 to 60 years. The rails are sold at 6 to 8 dollars per 100, and the posts at 12 or 15 cents each.

Mr. Brunel did not think it was a cheap or a strong wood. He had used it chiefly for covering locomotive boilers, as it resisted heat better than any other wood. When he purchased some there was but little in the market, and it was consequently dear.

Mr. Joseph Horne objected to its use for sleepers on account of its tendency to split so easily; but he had found it resist wet perfectly.

April 7.—The President in the Chair.

The following were balloted for and elected:—**Thomas Hawksley,** as a Member; **William Pole and John Dickenson, as Associates.**

"*Account of a series of Experiments on Locomotive Engines, more particularly on the 'England,' the 'Columbia,' and the 'Atlantic,' manufactured by Mr. Norris, of Philadelphia.*" By Captain Moorsom, R.E., Assoc. I.C.E.

The engines of which the author more especially treats were constructed by Mr. Norris, of Philadelphia, and sent by him to England, under an agreement to supply "locomotive engines of a higher power, greater durability, and less weight," than could be obtained in this country. They were to be subjected to fifteen trials within thirty days, and prove their capability of drawing "up a gradient of 1 in 330, a load of 100 tons gross weight at the speed of 20 miles per hour; and up a gradient of 1 in 180, a load of 100 tons gross weight at the speed of 14 miles per hour." The pressure of the steam in the boiler was stipulated by the Grand Junction Company (on whose railway the trials were made) not to exceed 60 lb. per square inch.

The construction of these engines is very simple, and the work plain. The boiler is horizontal, and contains 78 copper tubes, 2 inches diameter and 8 feet long each, with an iron fire-box. The cylinders, 10½ inches diameter, are slightly inclined downwards, and so placed that the piston rods work outside the wheels, thus avoiding the necessity of cranked axles. The frame is supported by 6 wheels; the two driving wheels, of 4 feet diameter, are placed close before the fire-box; the other 4 wheels, of 30 inches diameter, are attached to a truck, which carries the front end of the boiler, and is connected with the frame by a centre-pin, on which it turns freely, allowing the truck to accommodate itself to the exterior rail of the curve, and with the assistance of the cone of the wheels to pass round with very little stress upon the rails.

	Tons.	Cwt.
The weight of the engine, with the boiler and fire-box full was	9	11¼
That of the tender, with 21 cwt. of coke and 520 gallons of water, was	6	4¼
Total weight	15	15½
The engine, when empty, weighed	8 tons.	

The trials were made on the Grand Junction Railway in April and May, 1839, and were continued over the whole distance from Birmingham to Liverpool, except when stopping short at Warrington to take loads; and occasionally making double trips, so as to travel the total distance of 156 miles per day. Attention was more particularly paid to the speed when ascending the gradients, which rise at the rate of 1 in 330 (16 feet in a mile), or 1 in 177 (29 ft. 4 in. per mile), and as the engines approached these gradients frequently either at an accelerated or a diminished speed, the observations were made at the points most remote from the cause of variation from uniform velocity. Some of the trials were made with such a number of empty waggons to make up the weight, that the train attained a length of nearly an eighth of a mile: this required some allowance, which was estimated at from one-eighth to one-ninth in addition to the actual weight of the empty waggons.

The extreme limit of working pressure of the steam in the boiler was 62 lb. per square inch, except for a few minutes on one occasion, when it rose to 64 lb. The usual pressure for the locomotive engine boilers on railways now generally at work, is from 50 to 75 lb. per square inch.

An analysis of the tabulated results of the several trips give these general results:—that on a plane of 1 in 330, with a load varying from 100 to 120 tons, the speed varied from $13\frac{8}{10}$ miles to $22\frac{1}{2}$ miles per hour; that on a plane of 1 in 177, with a load of 100 tons, the speed varied from $9\frac{8}{10}$ miles to $13\frac{8}{10}$ miles per hour.

From the analysis it appears, that allowing in five of the trials the stipulated amount of performance to have been made, and that in five other trials a doubt may exist, still in the remaining eleven trials the exact amount of duty demanded was *not* performed.

A comparison of the journeys *up* from Liverpool to Birmingham, with those *down* from Birmingham to Liverpool, gives rather a singular result. The aggregate rise of the gradients from Liverpool to Birmingham is about 620 feet, that from Birmingham to Liverpool is about 380 feet (exclusive in both cases of the Liverpool and Manchester Railway); the difference, therefore, up to Birmingham is about 240 feet. In 7 journeys of 596 miles up to Birmingham, the engine conveyed 682 tons gross, evaporated 12,705 gallons of water, and consumed 177 sacks of coke (1½ cwt. each). In 7 journeys of 596 miles down from Birmingham, the same engine conveyed 629 tons gross, evaporated 12,379 gallons of water, and consumed 177 sacks of coke. It would thus appear that the consumption of fuel was the same in both cases, and the only difference was the evaporation of 326 gallons of water more in the journey up than in the journey down, conveying nearly the same load both ways.

The author remarks, that in the early stage of his observations on the engine, he would have inferred that, from the mode of construction, it was not calculated for high speeds, such as are required for the mail trains; yet that he has often seen it travel with apparent ease at the speed of 30 miles per hour; and he thinks that, with some slight modification of the working parts, engines of this construction may be made to do any duty now required from locomotive engines; and, from the small quantity of repair required during the trials (only renewing the fire-bars, which were originally intended for burning wood, and putting nine stronger ferules in the tubes), he is of opinion, that the present construction is exceedingly well calculated for heavy loads—that it may be modified for attaining high speeds—and will prove a durable and economical machine.

Captain Moorsom, in reply to some questions from several members, stated, that although the American locomotive engines had not strictly complied with the stipulated conditions, yet he considered them good, serviceable engines, and it was the intention of the directors of the Birmingham and Gloucester Railway Company to have ten of them on their line. The price of the engine complete, including the import duty of 20 per cent., is from £1500 to £1600. One of the greatest advantages of the engines is the facility afforded by the truck for going round curves—the same engineers managing indiscriminately the ordinary six-wheel engines, and the American ones are observed to go faster round the curves with the latter than with the former. Round a curve of 10 chains radius, they had gone at a speed of 20 miles per hour. They run also quite as well on a straight road. He had travelled on them between Whitmore and Crewe at the speed of from 30 to 40 miles per hour. They appeared less likely to be thrown off the rails than other engines, as in some instances they had run over the short pointers of the Grand Junction Railway—the engineer had merely felt a slight jar, but no accident had occurred. He attributed this to the truck adapting itself so readily to the rails. The coke used in the trials was the same as that in daily use on the Grand Junction Railway, and was of average quality. The mode of attaching the tender to the engine was peculiar, and he conceived it to be advantageous, as it threw a portion of the weight upon the engine and was an assistance in starting. The engines, as they are now constructed, will do well for all ordinary speeds; but if higher speeds are required, a greater expense must be incurred, and certain alterations must be made in them.

Mr. Bury conceived the chief peculiarity of the engine to consist in the end of the boiler being placed on the moveable truck, which certainly enabled it to adapt itself easily to any curve in the railway. The cylinders are in the same position as those in the first of Stephenson's engines, and the other parts are as nearly as possible identical with plain engines constructed in England. The pointers on the Grand Junction Railway are constructed and placed in such a manner as not to throw off a carriage which might run over them, and a four-wheeled engine would not have been thrown off by meeting a closed pointer. To enable him to form a correct comparative estimate of the work done by these engines, it should be shown what power was exerted at the wheels. This was a clear mode of arriving at a result and comparison with other engines.

Mr. Donkin remarked, that the flanches on the wheels appeared to be all that retained them on the rails, and that the truck turning on a centre-pin would allow considerable lateral friction, unless there was some mode of keeping the truck in a proper position when on a straight line of railway. If this kind of engine is superior to those generally in use in this country, it must be in some part of the construction which is not shown in the model or by the description. He inquired whether, in any of the four or six-wheeled English engines, any provision is made for changing the position of the axles, so as to allow of a divergence from parallelism when rounding curves.

Mr. Bury replied, that in the engines on the Leeds and Manchester Railway, although the axles were placed parallel to each other, a considerable allowance was made in the journals of one pair of the wheels, so as to facilitate the passage round curves.

The President observed, that the wheels being turned conically was of much assistance in passing curves, even although the axles were confined by the journals in a parallel position. He was aware that this threw an extra strain upon the curve rails, but that would only require more attention in securing them than on the straight line of railway.

"*Model of the Coal Field of the Forest of Dean.*"

Mr. Sopwith exhibited a model of a tract of 36 square miles of Gloucestershire, comprising the mining districts in the Forest of Dean. This model showed all the undulations of the surface, the towns, villages, and detached buildings, railways, coal and iron mines; and separating vertically through the centre from north to south, and from east and west, exhibited the geological formation down through the coal measures to the old red sand-stone: the construction is such that, by lifting off horizontal layers, the extent and position of each bed of coal is shown, with the extent of the workings in the different collieries, and on each bed is marked the portion that can be worked by level and freed from water by natural drainage. This coal tract forms an elliptical basin; the longest diameter of which, from N. N. E. to S. S. W. is about 10 miles, and the shorter about 6 miles, ranging round Coleford as a centre. There are about 20 beds of coal of various thickness, containing together nearly 37 feet of clear coal. The carboniferous strata crop out regularly all round against the mountain lime-stone and old red sand-stone, and dip uniformly towards the centre of the basin. This could scarcely be shown clearly, even by an almost indefinite number of plans, which induced Mr. Sopwith to project the model, the method of constructing which he described to be by framing together in squares a given number of thin strips of wood, joining them by half lapping at the intersections; on these strips, the profiles of the sections were drawn, from measurements and borings. The compartments of these skeleton frames were then filled in with lime-tree wood, as being lightest and easiest to work, and carved out to the depth of the lines drawn on the strips; by these means a series of horizontal sections fitting into each other were obtained, and when painted of the proper colours, both on the surfaces and on the edges, produced the complete model which he exhibited. The cost of it was about £30 complete. It was constructed under Mr. Sopwith's direction, and from surveys made by him for the Government.

April 14.—The President in the Chair.

The following were balloted for and elected:—James C. Sherrard, and George H. Phipps, as Members; and John Harris, as a Graduate.

"*Description of the Steam Ship 'India,' with a table of the proportions of large Steam Ships.*" By Lieutenant E. N. Kendall, R.N., Assoc. Inst. C. E.

This vessel was built at Greenock by Messrs. John Scott and Sons, and the engines were constructed by Messrs. Scott, Sinclair, and Co. To render her eligible as a packet ship between London and Calcutta, *via* the Cape of Good Hope, the timbers were lengthened so as to admit of the quarter deck and forecastle being raised 2 feet more than is usual; by which means a flush deck was formed along the whole length of the vessel, 200 feet by 29 feet, materially adding to the comfort and convenience of the passengers.

The long flat floor, with straight sides and fine ends, adopted in all the best of the Clyde-built ships, for the purpose of attaining a considerable speed with comparatively small power, and uniting with a light draft of water a good capacity for cargo or passengers, has been adhered to, although the established usage on the Clyde of making the length six times the beam has been somewhat exceeded, without impairing the speed, as the voyage from Greenock to London was made in 86 hours, against a strong head wind during a considerable portion of the time.

The rigging is fitted so as to combine lightness with strength, and the facility of making every thing "snug" when steaming against the wind; the spars being so proportioned as to carry a large spread of canvass when running down the trade winds. There are several improvements in the rigging. Two of them are particularly mentioned. 1st. The employment of iron sockets, into which the shrouds, having been tapered, parcelled, and served, are inserted and firmly rivetted. Instead of passing over the mast-head, they are attached by shackles to a series of holes along the edge of a strong wrought-iron plate or cap which surrounds the mast. This is more secure than the ordinary fastening, as it prevents all chafing or injury from the wet, besides being more compact, and allows any repairs to be more easily effected. 2nd. The mode of fitting the foreyard for coming down readily in bad weather. The truss bow is made sufficiently large to admit of the heel of the fore-top mast passing readily through it, and has on its fore-end an eye through which passes an iron bolt, 5 feet long, which is held in its position by a chain passing round the mast-head; to the lower end of the bolt is attached a chain, which passes through a swivel eye on the yard, and is drawn tight by a screw traversing one of the deck-beams. When the yard is hoisted up, it slides along the chain jackstay, which prevents it from swaying about until it reaches the bolt which enters the swivel eye, and when it is close up, the yard is slung by two short chains shackled on to the mast-head chains. The operations of striking the yard and top-mast may be thus accomplished simultaneously in a few minutes in the worst weather, or they may be replaced in the same short period.

The engines have most of the acknowledged improvements, and are fitted with "Hall's Condensers" in such a manner that they can work with them or with the ordinary condensers. The cylinders are 62 inches in diameter, with 5 feet 9 inches stroke. The diameter of the paddle-wheels is 26 feet; the length of the floats is 8 feet, divided into two parts in the depth, and fixed one before and the other behind the arms. There is an apparatus for cutting off the steam at any portion of the stroke. The boilers are of a peculiar construction, combining vertical flues with a series of horizontal fire tubes, exposing a very considerable surface so as to be worked by slow combustion of the fuel from two sets of fire-places over each other; by throwing on the coals alternately, the gas evolved from the fresh fuel is ignited in its passage over the other fire-places. A considerable economy has been effected by these means.

The paper is accompanied by a drawing of the improvements in the rigging, with plans of the vessel and engines, and a tabular statement of the proportions and scantling of a number of other large steam ships.

ON IRON AND TIMBER BUILT SHIPS.

On the Nemesis private-armed Steamer, and on the comparative efficiency of Iron-built and Timber-built Ships. By Augustin F. B. Creuze, of H. M. Dockyard, Portsmouth.

(From the United Service Journal.)

Most persons who take any interest in naval affairs will have observed, for some years past, occasional notices in the newspapers, of boats and vessels built of iron. It appears to be very probable that this material may eventually almost wholly supersede timber in the construction of boats, barges, steam, and the smaller classes of sailing vessels; and therefore any information as to the manner of building such craft, or on their qualities, and the comparative increase either of safety or danger, by the substitution of iron for timber, must be worthy of notice. The Nemesis, a steam-vessel of nearly 700 tons burthen, and built wholly of iron, has been lately docked at her Majesty's Yard, at Portsmouth, for the purpose of having damages repaired, which she had sustained by striking on a rock off Scilly, in thick weather, when on her passage from Liverpool to Odessa. This afforded a most favourable opportunity of obtaining considerable insight into the details of an iron vessel, while the courteous anxiety displayed by the gentleman who built her, Mr. Laird, of the Berkenhead Iron Works, at Liverpool, and by the officer, Mr. Hall, a Master in the Royal Navy, who commands her, to give every information that was in their power, removed all the difficulties which generally attend such a task. The following particulars, as far as facts are concerned, may therefore be relied upon as correct: the opinions which may be intermingled with those facts must, of course, be received only as such. The dimensions of the Nemesis are as follows:—

Length between the perpendiculars	165
Length over all	184
Length from stem to taffrail	173
Breadth	29
Depth	11
Burthen (old measurement) tons	660

The keel-plate was laid in August of the last year; the vessel was launched in November; her engines put on board, and she herself tried in December; and, finally, she was ready for sea by the middle of January.

The vessel is built almost entirely of iron; the exceptions being the planksheer or gunwale, which is of oak 4 inches thick and 10 inches broad, brought upon and secured to a planksheer or gunwale of angle iron; the flat of the deck, which is of 3-inch fir; four beams under the deck, 9 inches square. These are forward, and support the carrick-bitts, paul-bitts, and the foremost gun. The remainder of the beams, with the exception of the paddle-beams, which are of oak, 12-inch sided and 14-inch moulded, are of iron. The knee of the head, the rudder, the paddle-boxes, and a light berthing above the gunwale, about 2 feet 8 inches high, are of wood. The coamings and fittings upon deck are generally of wood, although for these purposes more iron is used in the Nemesis than in timber-built vessels. The cabins and fittings for the officers, passengers and crew, are of wood, and are very neat and handsome.

The mean launching draught of water—with masts, yards, rigging, anchor, and cable, with the cabin fittings in a forward state—was, according to the information afforded by Mr. Laird, 2 feet 4½ inches. The mean load draught, with 12-days' full supply of coals, water and provisions, for a crew of 40 men for 4 months, and 3 years' ship stores of all sorts, with duplicate and extra machinery, is also stated to have been 6 feet.

The engines were made at Liverpool, by Messrs. Forrester and Co. The diameter of the cylinders is 44 inches, and the length of the stroke 4 feet. The estimate in horse-power for the two engines is 120. The framings or supports for the engines are of wrought iron. It is usual to have them of cast iron. The greater strength of wrought iron enables them to be made of much less size and weight, and their appearance is also necessarily lighter. The boilers may be worked either separately or together. The paddle-wheels are 17 feet 6 inches diameter to the inner edge of the rim. The floats, which are 16 in number, are 6 feet 9 inches long, and 14½ inches broad. The paddle-shaft is 78 feet abaft the fore-end of the water-line. The vessel carries two 32-pounder medium guns, one forward and the other aft, on pivot-carriages, to fire over all; and it is this which constitutes one of the chief points of interest in the Nemesis. The guns are reported to have been fired several times with an extra charge of powder, and double-shotted. The concussion has left no visible traces on the vessel: and, the experiment, as far as it has as yet been carried, certainly does not militate against the adoption of iron in the construction of ships for war.

The fore-mast rakes 2 feet in 20, and is 32 feet abaft the fore-end of the water-line. The main-mast rakes 1 foot in 20, and is 111 feet 6 inches abaft the fore-end of the water-line. The bowsprit steeves 5 feet 6 inches in 20 feet. The following are the dimensions of the spars:—

	Length, ft.	Diameter, in.
Fore-mast, from deck to hounds	42	15
Fore-mast, from head	8	—
Main-mast, from deck to hounds	42½	15
Main-mast, from head	8	—
Fore top-mast	24	10
Fore head	4	—
Sliding gunter-mast	28	6
Sliding pole	8	—
Main top-mast	33	10
Main pole	13	—
Fore gaff	23	7½
Main gaff	23	7½
Fore-yard cleated	52	10½
Fore-yard arms	3	
Fore topsail-yard, cleated	36	8½
Fore topsail-yard arms	2	
Fore topgallant-yard, cleated	25	6
Fore topgallant-yard, arms	1½	6
Bowsprit, out-board	21	15
Jib-boom, out-board	13	8
Jib-boom, in-board	13½	—

The form of the midship section may be best described by saying that it is an oblong, 11 feet in depth and 29 in breadth, with its base curved downwards 6 inches in 15 feet, to the middle line of the keel, its sides slightly curved outwards, and the lower corners rounded off in the arc of a circle to a radius of about three feet. The midship portion of the body, in which the engines, boilers and coal lie, preserves much the same section throughout its length. Forward and aft, the form becomes finer, and gradually approximates to the usual bow and stern of sailing vessels. The stern-post is plumb. The stem rakes forward of the perpendicular at an angle of 16°. It may here be remarked, that the body is throughout remarkably fair; and that an observer, standing either before the stem looking aft, or abaft the post looking forward, can detect no more difference, if any there be, between the two sides, than would be observed in a vessel built wholly of wood.

With respect to the method of connecting the various parts, strictly speaking there is no keel, although the lower plate of iron, which connects the two sides of the ship, and which is about a foot in breadth, is called the keel-plate. This plate is slightly curved, with its convex side downwards, so as to form a channel for water in the direction of the length of the vessel, under the floors. The floors are straight bars of angle iron, with one flange, four inches wide, lying horizontally; the other 9 inches deep, hanging vertically. The vertical flange is connected to the bottom-plates of the ship by 3-inch angle iron—that is, angle iron of 3 inches width of flange. Upon the upper surfaces of the floors, five ranges of sleepers, of timber 12 inches square, and extending the whole length of the hold of the ship, are laid, and securely bolted to the horizontal flanges of the floors, by 1-inch bolts, their points secured under the flange of the floor by nuts on to screws at these points. The frames, which are of angle iron 3 inches wide, are 18 inches apart along the midship body of the vessel; but forward and aft this space is gradually increased, until they become about three feet apart. The in and out flange of the frames is riveted to the vertical flange of the floors by ¾ iron rivets, about 6 inches apart. The iron plates forming the planking, or rather skin, of the vessel, are secured to these frames by being riveted to the other flange of the frames with rivets of ¾ iron, which are distant apart about 3 inches from centre to centre.

The connection of the sleepers or keelsons, which are of red-pine timber, with the iron floors, and of the floors with the frames, and of the iron plates with these frames, may be more easily understood by reference to Fig. 1. The rivets by which the plates are secured to the frames, are put in from the inside of the vessel, and are clenched flush on the plate; the outer part of the hole through the plate being counter-sunk to receive the rivet, so that the bottom of the vessel is a perfectly even and smooth surface. The whole of the riveting is performed with rivets heated nearly to a welding heat; therefore, the contact between the surfaces of the iron is exceedingly perfect, as it is insured not only by the care applied to the riveting, but by the contracting of the rivets in cooling. The frames run up to and end upon the iron gunwale, which has been before mentioned. This is of 3-inch angle iron, with one flange horizontal, to which the 4-inch wooden gunwale is secured by screw-bolts; the other flange is vertical, and to that the upper ends of the frames are riveted. Between the wood and the iron forming this compound gunwale, felt is laid, which is so firmly compressed by the screw bolts, that the joint is perfectly water-tight. The beams are of iron, and formed by two bars of angle iron, having their vertical flanges back to back, with a bar of iron 9 inches deep and ½ of an inch thick riveted between these two vertical flanges. The deck is of fir, 3 inches thick, lying upon and being secured down to the horizontal flanges of the beams by screw bolts, the heads of which are sunk about ½ an inch below the surface of the plank, and are hidden by plugs driven down upon them with white lead. Thus the fastenings of the deck are scarcely perceptible. The points of these bolts are secured beneath the horizontal flanges of the beams by nuts on a screw. The connection of the angle-iron gunwale with the wooden gunwale and with the planking; also, the connection of the deck with the beams, and the method of forming the beams, will be more easily understood by the following sketches: (Figs. 2 and 3.)

Fig. 3.—Section of beam.

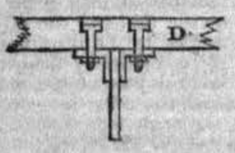


Fig. 1.

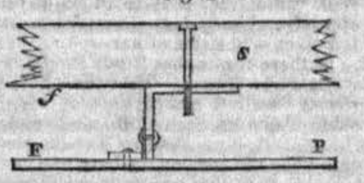
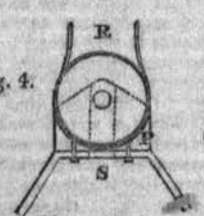


Fig. 4.



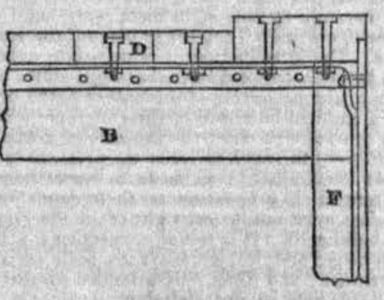


Fig. 2.

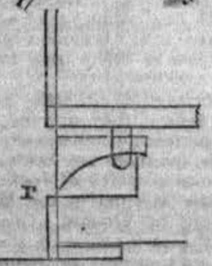


Fig. 5.

REFERENCE—Fig. 1.—S, sleeper. P, iron plate. *f* F, frame between.
Figs. 2 & 3.—D, deck. B, beam. F, frame.
Figs. 4 & 5.—R, rudder. P, port. S, stern.

The ends of the beams are secured to the sides by angle-iron knees. The paddle-beams, which, it has been before said, are of timber, pass the sides of the vessel through what may be called sockets, formed by bars of angle iron placed above, below, and on each side of them. One flange of each bar is firmly riveted to the planking of the vessel; and the other flange is secured to the beam by screw bolts. Felt is also inserted here in the joints between the wood and iron. This appears to be a general precaution in similar connections.

The stem is formed of sheet-iron, in the same manner as has been already described for the keel. At the lower part of the stem there is a sort of socket of iron, which forms the gripe, and in which the lower end of the wooden knee of the head is inserted. It has been already mentioned that the rudder of the Nemesis is of timber; but this appears to be an exception to the general practice in these iron vessels. The main piece inclusive of the head, is usually of iron; and when of iron, is thus formed and connected with the stern-post. (Figs. 4 and 5.)

The stern is strengthened by a fashion-piece of angle iron; and the tie across the stern is by a transom, also of angle iron. The berthing all round the vessel, already mentioned as being of fir, is secured to short top-timbers of wood, which are let through the gunwale and run down about two feet below it. They are secured by two riveted bolts through the planking of the vessel; and at their intersection with the iron gunwale, by angle iron on each side.

The sheets of iron which form the planking of the vessel are about 8 feet long and 2 feet 6 inches broad. Of course, these dimensions vary according to the place of the sheet in the body of the vessel. The lower 6 strakes which form the bottom, and extend from the keel-plate to the turn of the bilge, are clinker-built. The strake at the turn of the bilge, and the 5 strakes which form the side of the vessel from this turn upwards, are carvel-built. The lands of the clinker seams are riveted with ¾ iron rivets similarly to the lands of a clinker-built boat, without any strengthening bands. The carvel seams, and the buts of both clinker and carvel strakes, are secured by bringing the edges of the plates in contact, and riveting each edge to a strip of plate-iron, lying on and lining the inside of the joint. The seams are caulked by closing the edges of the two plates together with blows of a cold chisel. The whole of the rivets are flush on the outside of the vessel. The keel-plates are 7-16ths of an inch in thickness. The clinker-worked plates covering the bottom of the vessel are ⅜ths of an inch in thickness; and the carvel-worked plates, covering the top-sides, are from 5-16ths to ½ of an inch in thickness. The iron work is first painted with several coats of red lead, and then varnished with a patent varnish. This covering to the iron did not appear to be at all disturbed on any part of the bottom excepting where it had been rubbed off by the rocks on which she had grounded.

There are several peculiarities in the internal arrangements of the vessel. The whole internal space is separated into seven water-tight compartments, by six iron athwartships bulkheads.* Four of these—those in the wider part of the vessel—are of 5-16ths of an inch iron. The bulkhead nearest to each extremity, being of small surface, and liable to less immersion, is only 3-16ths in thickness. The wooden sleepers necessarily pass through each of these bulkheads, and they are secured where they pass through by strong flanges bolted down to them over felt, and riveted to the bulkheads, so that no water can possibly pass from any one compartment to the other. Therefore, a leak which may be sprung in any part of the bottom of the vessel, can only affect that compartment between the bulkheads of which it happens. Thus the damage caused by the rock on which she struck, admitted 4 feet of water into the compartment in which it occurred, before the leak could be stopped, but there was none in any other part of the vessel. There is a small hand-pump fitted to each compartment, the pipe from which leads into the hollow of the keel-plate. Large pumps are not necessary, as the compartment can only fill to the level of the external water, and may then be emptied at leisure; or, if the leak be greater than the discharge of the pump, may remain filled until a port is reached.

In the space between the engines and the boilers, usually called the stoke-hole, there is a very ingenious means adopted to strengthen the body, without interfering with the accommodations of the engine-room. This is the introduction of a partial bulkhead with an aperture bounded above by an erect, and below by an inverted arch of bar-iron; thus supplying by mechanical contrivance the support which otherwise could not be obtained for this part of the body, without great inconvenience. To obviate the disadvantages attendant on the small draught of water which this vessel draws, there are two sliding keels, similar in principle to those which were originally proposed by Capt. Shank, of the Royal Navy, when in command of the British force on the American Lakes, during the War of Independence. These keels are each 7 feet long, and capable of being protruded 5 feet below the keel of the vessel. They are of wood, 4½ inches thick, and each works up and down by means of a small windlass and an endless chain, in a water-tight case or trunk 12 inches wide, formed like the rest of the bulkheads, of sheet iron, and running from the bottom of the vessel up to the deck. The plates of these trunks are 7-16ths of an inch thick, and they are strongly secured by angle iron to the athwartship bulkheads, which they also serve to support.

The report of the officers on the advantage which they derived from these keels, when under sail, in enabling them to keep the vessel up to windward, and in keeping her steady, is very favourable. In fact, they are an ingenious modification of the lee-board. One of them is situated just before the engine-room, and the other just abaft it. There is also a contrivance by which the depth of the rudder in the water may be increased whenever these sliding keels are used.

Having now described the vessel, we will proceed to describe the damage she sustained by striking. When she struck, her speed is reported to have been nearly 9 knots: her average speed was 8½. The first blow was evidently received exactly in the centre of the front of the fore-foot or gripe, which was dented in about 3 inches, and split about 8 inches in its length. This blow must have been inflicted by a rock at least as sharp as the pea of a moderate sized anchor. The blow appears to have been repeated under the keel-plate, about 7 feet abaft the fore-foot, but there it only occasioned a slight, though long indentation. The principal damage was on the starboard side under the bilge, and at the station of the foremost bulkhead. The outside plate or planking was cut through by the blow having forced it on to the edges of the bulkhead plates; and the lower plate of the bulkhead was broken by this pressure. The wooden sleeper, which lay on the iron floor almost directly above the blow, was started up 1½ inches from off the floor, and the iron bolt which secured it to the floor was broken.

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* We have been told that this method of dividing the whole length of a vessel into separate water-tight compartments is adopted in all sea-going Chinese junks. We trust our naval men engaged in those seas will keep their eyes open to these and many other interesting particulars respecting the Chinese vessels—for a description of which our pages shall always be open.—EDITOR.

The blow, to have produced such damage as has been described, must evidently have been very severe. It apparently clearly establishes that the injury affects the part struck only, for the rivets seem to have held as tight, and the contiguity of the plates of iron to have remained as perfect after the blow as before it had occurred, excepting only the plates cut by the bulkhead. There might have been a very rational doubt, before the experience this accident has afforded, whether, under such an injury, sheets of iron would not have rent almost as sheets of paper would tear; and whether the rivets would not have started by the dozen at a time, as the stitches in the seams of a sail. Several of the plates abaft the cut plates were indented in a long wavy indentation. The greatest depth of the indentation occurred at the cut, where it was 3½ inches.

The injuries were repaired by placing a shoe over the fore-foot, somewhat similar in shape to the shoe used to drag the wheel of a carriage when going down hill. This shoe was riveted strongly, by rivets passing through it and the gripe, from side to side. The two plates of the bottom which were cut, and the plate of the bulkhead which was broken, were taken out by punching out the rivets, and new plates were substituted for them. Those plates which were only indented were taken out, straightened in the fire, and replaced. A small quantity of the angle iron framing, connecting the bulkhead to the bottom, was also removed, and substituted by new. According to information afforded by Mr. Laird, the weight of new materials used in the repairs was under 3 cwt. and the expense for the materials, and wages of the smiths and riveters, about £30; which, he says, would have been diminished to £20, if he could have had the facilities that are afforded by his own factory.

It is not easy to institute any comparison between the expense of this repair and that of a similar accident to a timber-built ship; because we cannot ascertain what would have been the extent of the damage. If any timbers had been broken, which would in all probability have been the case, the expense would have been much greater. But unless timbers had been broken, the mere upsetting of the gripe of a ship, the rubbing off of a few sheets of copper, and the shifting of a plank or two, would not have involved expense much exceeding that of the repair of the Nemesis.

Before the vessel was grounded upon the blocks, sights were placed towards each extremity, 140 feet apart, with a third sight between them. By means of these sights, observations were taken before and after grounding, and the deviation from the straight line, in the length of 140 feet, was only a quarter of an inch.

Two questions now naturally arise:—1. What are the advantages or disadvantages of the substitution of iron for timber in the construction of ships? —2. To what limit may this substitution be advantageously carried? Among the advantages are the employment of a less material, of which the supply is inexhaustible, and for which supply we are totally independent of other nations. Also, the greater durability of the material, not only arising from its relative durability with that of timber, but from its requiring no metallic sheathing to protect it from the ravages of worms. Also, the greater durability of the structure as a whole, in consequence of the greater permanency in the perfect combination of its several parts, arising from the fastenings being of the same hardness of texture as the portions of materials brought into connection. The metallic fastenings to a timber-built vessel act, it must be remembered, not only chemically but also mechanically, to accelerate her destruction, immediately the close connection of the several parts is at all diminished.

These appear to be the principal advantages of iron in connection with the question, as far as first expense of material and durability are concerned. But these considerations are independent of the expense in relation to the comparative total quantities of materials required to build a ship of each sort. For it must be remembered that the iron-built vessel is of iron alone; the timber-built vessel is of timber, iron, and copper.

Were it possible to compare an iron-built ship with one entirely built of timber, setting aside the question of durability, undoubtedly the advantage would be wholly on the side of the timber-built ship. For the strength of oak is one-fifth that of wrought iron, and its weight is only one-eighth that of wrought iron. But this comparison is untenable, because of the great quantity of metal which necessarily enters in the construction of the timber-built ship, by which its relative weight is very much increased, and its relative strength diminished. By the term "timber," in speaking of a timber-built ship, a compound of timber, copper and iron is meant, having less strength in proportion to weight than the timber alone, but greater weight in proportion to strength. It is impossible within the limits of this paper to investigate the actual weights of wood, iron, and copper, which enter into the composition of a timber-built ship, in order to ascertain the exact answer to the question as to which is the heavier material in proportion to its strength, the "timber" of the timber-built ship, or the iron of the iron vessel. We shall, however, assume as correct that which we believe would be found to be so, viz. that the material of the timber-built ship would be the heavier in proportion to its strength, and shall proceed to the further investigation of the original questions on that assumption. Therefore, by the substitution of iron we obtain equal strength with less weight of material. From which advantage it follows, that if the "timber" and the iron vessel be each built for the same loaded displacement, the iron vessel, with equal strength will be capable of carrying a heavier cargo, and with greater strength an equal cargo. Also, that if a "timber" and an iron vessel be built of the same strength, and to carry the same weight of cargo, the iron vessel may be of less displacement, and consequently smaller in dimensions, or if of less displacement with the same dimensions, may be more advantageously formed for velocity and for weatherly qualities. The small dimensions involve the advantage of light draught of water, diminished expense, and less numerous crew. The diminished displacement with the small dimensions involves quicker return of capital and greater safety in navigation.

The answer to the second question, as to the limit in the size of the vessel to which the substitution of iron for "timber" may be carried, appears also to be involved in the foregoing considerations. For, if greater strength may be obtained with equal weight of material, or equal strength with less weight of material, there can be no limit short of that limitation which may equally apply to "timber." And, by an application of the foregoing reasoning to the question at issue, it appears that a first-rate may be more strongly built of iron than of timber, with the same light displacement, and equally strong built, but capable of carrying a greater quantity of water, provisions, and stores, with the same load displacement; or, equally strongly built, and capable of carrying an equal quantity of water, provisions and stores, with a less load displacement. This may appear to be a bold and startling result of our investigation: but if our original assumption be correct, it is nevertheless, within the bounds of truth. Nay, it is even an under estimate of the limit to the substitution of iron for wood in the construction of ships. For the limit to the possibility of constructing a fabric of any conceivable dimensions is necessarily dependent upon the ratio of the strength of the material used to its weight. And as this is greater in iron than in the "timber" of the timber-built ship, the limit of dimensions for the iron-built ship is more extended than the limit of the dimensions of the timber-built ship.

It may, perhaps, be necessary to repeat that the word "timber" in this investigation means the copper, iron and wood of the timber-built ship.

If we take into consideration the very few years that have passed since the first application of iron as a total substitute for timber in building ships, it is astonishing to what perfection this branch of art has arrived; and, consequently, very great credit attaches to Mr. Laird, for the intelligence and talent which he has displayed in thus adding to the manufacturing resources of this country. As the art proceeds, and becomes more general, there can be no doubt that great improvements will be made. This is said without the slightest intention of withholding from Mr. Laird the high meed of praise which is so justly his due. In speaking of the progress of improvement, we are too prone virtually to set bounds to its advance; forgetful of the fact that perfection being unattainable by mortals, it is a mere abstract term, meaning one thing yesterday, another to day, and another tomorrow. One improvement, and that probably not an unimportant one, would be the diagonal arrangement of the plates or planking of the vessel, and also of the angle iron frames. Iron offers greater resistance to compression than to extension. And bar-iron offers greater proportionate resistance to extension than plate-iron. These facts, which have been ascertained by experiment, enable us to determine upon the positions in which to place the plates, so that the peculiarities of strength of the angle and bar-iron shall be most advantageously developed. The angle iron should be placed so as to act as trusses in supporting the weight of the extremities of the vessel; the weight or downward pressure of which is necessarily greater than the upward pressure of the water. The frames should, therefore, be placed with their heels toward the midship part of the ship, and their heads inclining forward in the fore body, and aft in the after body to an angle of 45 degrees with the horizon. The plates have already been described as connected together at their edges by being riveted to strips of bar-iron. These may form the ties, and the direction of these continuous bands should be at right angles to the direction of the angle iron frames. Thus the whole body would be divided by these two series of lines into compartments; which, in the vertical part of the body, would be squares, each with one diameter vertical and the other horizontal, as in the following sketch. The double lines are the angle iron frames, the single lines the continuous bars to which the edges of the sheets are riveted. Of course, the angle iron frames will receive the rivets of one series of seams, and therefore by this adjustment some small weight of iron will be saved.

The floors and all the lower part of the vessel may remain as in the Nemesis. The introduction of water-tight bulkheads is very good. This has been before attempted in timber-built ships, but has failed, from the ignorance of the projectors of the nature of the pressure of water. They assumed that a caulked bulkhead of three or four inches in thickness, that would be quite adequate to resist the pressure of a small depth of water, would also be of sufficient strength to resist the pressure to which it would be subjected by deeper immersion. Bulkheads, to resist the pressure of water, must increase in strength in proportion to their depth below the surface of the water. This fact must not be lost sight of in the construction of these water-tight iron bulkheads. It is not of consequence with small draughts of water; but when larger and deeper vessels are built of iron, it will become a question of importance; and if not duly attended to, the idea of safety from water-tight bulkheads may be most delusive.

The question of the durability of these vessels, of their little liability to accident, and of the ease with which damage done to them may be repaired, appears to be very clearly proved from the experience which has already been obtained on these points; and this is not little, for there are boats built by Mr. Laird in both North and South America; in all parts of India, and on the Euphrates and the Indus; in Egypt, on the Nile and in the Mediterranean; on the Vistula, on the Shannon, and on the Thames. One of these boats on the Savannah has been constantly at work for these last six years without any repair; which is a great test, if we consider the frequent, constant caulkings required to preserve a timber-built ship. There is also a steam-yacht built of iron, the Glow-worm, the property of Asheton Smith, Esq. This vessel has made the passage from Bristol to Carnarvon, a distance of 210 miles, in 18 hours. In the report to the House of Commons on steam-vessel accidents, we find the following stated of the Garryowen, one of these vessels:—"We went ashore about two cables' length to the eastward of the pier (Kilrush) and struck very heavy for the first hour. The ground under our weather-bilge was rather soft clay, covered with shingle and loose stones, some of them pretty large. Under our inside, or lee-bilge, the ground was very hard, being a footpath at low water. I was greatly afaid she would be very much injured by it in her bottom, but am happy to say she has not received any injury; in fact, her bottom is as perfect and as good as on the day she left Liverpool—not a single rivet started nor a rivet-head flown off. If an oak vessel, with the cargo I had on deck, was to go on shore where the Garryowen did, and get such a hammering, they would have a different story to tell. . . . Out of twenty-seven vessels that got ashore that night, the Garryowen is the only one that is not damaged more or less."

Colonel Chesney, the commander of the Euphrates expedition, writes thus of the iron vessels which were employed on that service:—"It is but right to tell you that the iron vessels constructed by you far exceeded my expectations, as well as those of the naval officers employed in the late expedition, who would one and all bear testimony anywhere to their extraordinary solidity; indeed, it was often repeated by Lieut. Cleaveland and the others, that any wooden vessel must have been destroyed before the service was one half completed; whereas the Euphrates was as perfect when they laid her up at Bagdad as the first day she was floated. As I am now occupied in preparing a work on the expedition, I shall have a better opportunity than the present of doing justice to the subject of iron vessels, for it is my belief that they will entirely supersede wood, on account of their comparative strength, cheapness, and durability, whenever people are satisfied that their only disadvantage—the free working of the compass—has been overcome.

REVIEWS.

Seville and its Vicinity. By Frank Hall Standish, Esq., Author of the "Shores of the Mediterranean," &c., 8vo. London, 1840. Black and Armstrong.

"The work now presented to the public," we are told in the preface, "contains an enumeration of almost all the Convents and Public Buildings, which existed in Seville during the last century, with their most remarkable contents in the present;" it is accordingly one, far more calculated to interest architectural and antiquarian readers, and those who study the history of art, than the public generally; for the description of the Alcazar and Cathedral alone, the one a splendid monument of Moorish, the other of Gothic architecture, extends to somewhat more than sixty pages. In fact, a considerable mass of information relative to architecture and the other arts, and to many Spanish artists, is here presented to the English reader, which has hitherto been hardly accessible to those who are unacquainted with Spanish. Instead of being as its title alone would, perhaps, lead us to suppose, a traveller's sketch of the city and its inhabitants, this volume is altogether topographical in form,—and so far rather a phenomenon in these days of 'light reading.' It is in fact rather one for study and reference, than for off hand perusal; and therefore we conceive, ought to have been furnished with that now almost obsolete appendage, an Index. Neither is that all we here desiderate, for we conceive that the Alcazar and the Cathedral might very properly have been made to furnish something like disquisition as to the Moorish and the Gothic architecture of the Spanish peninsula generally; and so also would the Lonja (here printed throughout Louja), or Exchange, have afforded an opportunity for discussing the peculiar character of the style transplanted from Italy in the 16th century. Something of this kind would have relieved the dryness of the work which is written too much in the usual technical Guide-book style. As it is, the volume is too much of a mere catalogue raisonné of buildings and pictures, and therefore likely to be considered dull by the many, and tantalizing by the few for whom it seems to have been more particularly intended; for as there are no illustrations of any kind—not even so much as a general plan of the city to enable us to form some distinct idea of its topography, little positive information, except as to historical facts, and names and dates, can be collected from it. Nor do we, we must confess, understand why so many minor—not to call them trivial, circumstances should have been brought forward in regard to a place so very unlikely to be visited by English travellers, and which requires to be described to the English public quite as much by the pencil as by the pen.

At present only one or two of its buildings are known to us, and those very imperfectly—the Giralda or Tower of Gever, some portions of the interior of the Cathedral, the Patio de Naranjos, the Sala de los Embazadores in the Alcazar, the Golden Tower, &c., which we meet with in Roberts' Spanish Sketches, and the Landscape Annual, and which are certainly calculated to excite a vehement desire for a complete acquaintance with those edifices, and with similar information as to others. Though not to be compared with the Alhambra, the Alcazar alone would supply materials for an architectural volume, if we may judge from the Sala above mentioned, and from some other views of the edifice, which we lately met with in a recent French publication, whose exact title we do not now remember. As to the Cathedral, we are here told the architecture is of all classes—Arabic, Gothic, the 'Plateresco,' and the Greek-Roman; yet, although all these are jumbled together, and an abominably unsightly "grand entrance" has been recently attempted—fortunately, not finished, by a Sevillian architect, Cano, and a good deal of the outside walls are left rough, "nevertheless, of all the cathedrals I have seen, this is the one which, upon the whole, has most pleased me in Europe," says the author. After this we naturally look for some vindication of such opinion—for some remarks that would explain to us, in what its particular charm and merit consists, more especially as we are told that, "the interior of this temple is of the plainest Gothic."—However, provided too much be not expected from it, we can recommend this volume to those—their number, we fear, is but small—who have not the means of consulting Ponz and Cean Bermudez, yet are desirous of obtaining more minute information relative to Seville, and Spanish art and artists than English publications will supply. For our own part, we greatly regret that Roberts did not return to the Spanish Peninsula, and devote his pencil to illustrating and recording the, at the present almost unknown, treasures it contains, in the class of architectural and picturesque objects, instead of proceeding to the Holy Land which is not exactly the land best fitted for the display of his talent. At all events, we hope that in these days of travelling, some other artist will visit the Spanish territory, and return with a portfolio well stocked with architectural subjects there to be met with in profusion, and of which we have, as yet, had no more than a mere whet—a slight foretaste, a provocative that is in itself quite provoking.

Egerton's Views in Mexico; being a Series of Twelve Coloured Plates, executed by himself from his Original Drawings. Large Folio. London, 1840. D. T. Egerton.

If it was not every one who could afford to visit Corinth, so neither have all of us, even in this age of steam navigation, the means or opportunity of taking a trip to Mexico; although in the course of another generation such a trip may become a very ordinary feat, and that too, in a still more expeditious mode than that by a sea voyage across the Atlantic,—to wit, in a balloon, should the experiments which are now actually making, to prove the practicability of such mode of travelling, be found to realize the sanguine expectations of its projector. In the meanwhile we are well content to take our ideas of Mexican scenery and vegetation,—of the costume of the people, of their habitations and cities, from Mr. Egerton, an artist who has not merely visited, but been long resident in the country, and whose drawings are no less attractive as landscapes, than they appear to be faithful and characteristic as local portraitures of the sites they represent. We say seem, because of course we cannot pledge ourselves, as eye-witnesses, to their veracity; but they certainly do bear very strong internal proofs of it, not only the general physiognomy of the landscapes and buildings, bearing testimony to it, but more especially the plants and shrubs in the foregrounds, whose particular characters are clearly discriminated.

Looking at these views as imitations of the original drawings, we may place them among the most successful attempts we have ever met with, to give the effect not of mere tinted ones, but the depth of tone, the vigour, the surface, and the peculiar execution of the modern school of water-colour drawing. Therefore, though the work is much higher in price than any of the masterly productions in lithography that have of late been published, it cannot be called dear, considering the great dimensions of the plates, and the time, labour and care bestowed upon the colouring, which has been executed under the artist's immediate inspection. Nay, as compared with what is frequently asked for a single drawing, not at all of more value as a work of art, than one of subjects forming this set, it may be termed cheap. One great advantage, too, attending the form in which they are done up, namely, their being a series of separate drawings mounted upon card board, and put into a portfolio,—is that any one or more of them may be selected and framed, and would then scarcely be at all distinguishable from an original or autograph production of the kind. A separate sheet of letterpress descriptions forms a very suitable accompaniment to the engravings, for the information it affords gives additional interest to the subjects it explains. Perhaps we cannot do better than quote by way of specimen the description of the first plate, the city of Puebla, as it commences with an observation that meets an objection very likely to be made by those who do not take into account the peculiarity of the climate where the scenery lies.

THE CITY OF PUEBLA.

In representing scenery within the tropics, where the atmosphere is so highly rarified, more particularly in situations that are considerably elevated above the sea, it is quite impossible to convey, to the inexperienced eye, an adequate idea of distances, which always appear to be lessened: and the hardness of outline, with the distinctive form of objects, as exhibited in faithful pictures, frequently subject the artist to the imputation of a want of skill :—thus, in the two mountains shown in this subject, they appear to come forward upon the eye, whilst their bases are at a distance in a straight line from the foreground, of about thirty miles. The sides of these mountains are covered with deep forests, extending from the base to that point where vegetation ceases to exist; this may be observed in the picture, where the grey tone of the forest is succeeded by a warm sand colour, and the higher elevation is distinctly marked by the snow, which perpetually covers the summit. The loftiest of these mountains, called Popocatepetl, stands at an elevation of 17,884 feet above the level of the sea (nearly three miles and a half), and at about 10,684 feet above the city of Puebla, from whence the crater of this volcano is plainly visible, the edge of which falls considerably towards the south side; it still burns feebly, and the surrounding country bears the devastating marks of violent eruptions; though no records have been kept of these. The neighbouring mountain, called Iztaccihuatl, is supposed to be an extinguished volcano—and these two form the barrier to a direct communication between Puebla and the Capital, which places are distant from each other about 70 miles, the former being 169 miles from the port of Vera Cruz. The city, a small portion of which only is seen in the picture, is the richest bishoprick in the country, and is celebrated for its fine cathedral, the altars of which are decorated with the most costly magnificence.

As likely to be interesting to several of our readers, we shall also copy what is said of the Mine of Rayas.

INTERIOR OF THE MINE OF RAYAS.

This mine, situated at Guanaxuato, is esteemed the richest upon the *Veta Madre* (mother vein). One of the principal *levels* is shown in this plate, "the cañon of San Cayetano." This excavation has been formed by blasting the rocks, amongst which the silver is disseminated in minute particles; occasionally threads and lumps of silver are found in a pure state, but these form an insignificant proportion to the mass. The principal shaft of this mine is of large dimensions, being 31 feet in diameter, of an octagonal form, and 464 *varas* deep (1,276 feet). In the lower workings, the air is very confined, and the heat rather oppressive, the mean temperature being 85° of Fahrenheit; in the level represented here it is 80°. The *Tenateros* (carriers) who convey the ore from the different workings to the bottom of the shaft, from whence it is raised to the surface, are paid according to weight and distance; they are, from long practice, rendered capable of bearing great weights—the average allowance is 9 or 10 *arrobas* (225 lb. and 250 lb.); but there are instances of their far exceeding this; and in the *Despacho* (office) of Santa Rosa, belonging to this mine, there are two masses of ore which have been brought up entire by one man, in successive journeys, one weighing 18 *arrobas* (450 lb.), the other 22 *arrobas* (550 lb.), which are kept as trophies of human strength. When it is considered that 500 lb. is the average weight that a mule carries, and that those masses were brought from the level shown in the plate, to a distance of 260 *varas* (nearly as many yards), with an ascent of upwards of 100 *varas*, it will appear more extraordinary. The miners, who are voluntary workmen, are a very superstitious race; they are subject to many accidents, from blasting, rush of waters, descending and ascending the shaft, &c.; but the limits of a short description cannot convey an adequate idea of the life of these singular men, which is full of stirring incidents.

The Palace of Architecture: a Romance of Art and History. By GEORGE WIGHTWICK, Architect. Imp. 8vo. 67 Plates and 143 Woodcuts. London: Fraser, 1840.

IF the singularity of its title is well calculated to excite curiosity, and the splendid appearance of the volume itself is likely to secure for it admiration, the author's aim is by far more singular than the one—more admirable than the other; while some of his opinions and remarks are so striking as to be absolutely startling. It is not the least extraordinary circumstance of all that, although a professional man, Mr. Wightwick is so free from professional prejudices, so ultra-liberal, in fact, that he is in danger of being considered highly illiberal in many parts of his book by his brother architects. That he is not at all anxious to have the art kept, as heretofore, a sort of close borough, is evident from the very first; nor is there any mistaking his object, which is nothing less than to divest the study of architecture of that kind of freemasonry, mystery, and mystification, in which it has hitherto been kept shrouded from the million. Nay, he even goes so far as to express the hope "that quackery may no longer practise its meretricious frauds, to the delusion of ignorance;" a pretty broad hint that there has been a good deal of quackery in architecture ere now, and that such quackery has succeeded mainly in consequence of the inability of the public to detect it, and to discern plodding feebleness and sterility of mind just *plated over* with the specious, yet superficial surface of art. In time, perhaps, the plating wears off, and people begin to be ashamed of the sorry stuff which they had been taught to look upon as sterling metal; but in the meanwhile the mischief has been committed, and the public have no other means of consoling themselves for the despicable specimens of taste foisted upon them, than by sneering at the want of discernment on the part of the generation which could allow itself to be so duped, notwithstanding that they themselves are probably gulled to the very same extent, although after a contrary fashion. Had the course here recommended by Mr. Wightwick been adopted a century ago, and had the study of architecture been considered one of the requisites towards a polite education, the art itself would, in all probability, have been in a very different condition among us from what it now actually is. If executed at all, many things that have in their day obtained praise, would have incurred derision at the very first. Hardly would such men as Taylor and Wyatt have obtained the celebrity they did—more to the astonishment of the present time than to the credit of their own—for their talent, more especially that of James Wyatt, is now beginning to be better understood, and rated at its actual worth, which is exceedingly low indeed, for he was at the best a complete mannerist, while his manner was at the best completely insipid. Nash's reputation is now scarcely worth a bawbee; nor would we give much for the reversion of that of Sir R. Smirke, whose frigid soulless *classicality* has impoverished our modern architectural style most deplorably.

Should Mr. Wightwick's counsel be followed, the next generation will not, we conceive, be put to its shifts, so much as the present one, to find competent judges in matters of architectural taste; whereas now it is universally complained that hardly two or three non-professional persons can be found at all qualified to be entrusted with the selection of designs at competitions. So far, therefore, Mr. W.'s book is eminently calculated to be of service, by inducing people to discard the fatally absurd prejudice that the study of architecture concerns architects alone. Either it is, or it is not, a fine art; in the latter case, of course it deserves to be applied to only by those who practise it; but in the other, it claims the attention of all who make pretensions to taste, and the more extensively it is cultivated the better, else how can the public sympathize with it?—how can they appreciate or enjoy it?—how should they encourage it properly, or wherefore should they encourage it at all? because a public without taste for architecture does not need architects, but merely builders. All this we take to be pretty self-evident, whether it be exactly palateable or not.

To ourselves it is most satisfactory to find that there is at least one individual in the profession, who, with no ordinary degree of eloquence and persuasion, strives to induce non-professional persons to apply themselves to architecture as one of those pursuits which of themselves reward the student. We do not say that others have actually dissuaded from such attempt, or that they have not occasionally acknowledged the ability and services of amateurs; but it has been as if they looked upon the latter as a class necessarily limited to a very few individuals, and those chiefly wealthy ones. Never do they seem to have contemplated the possibility of that class—if it now deserves the name of one—becoming a numerous one; for never have they uttered any exhortations to that effect; never have they recommended that architecture should be taught at schools and colleges; never have they pointed out what course of study in it would be most suitable for such purpose. Without doubt every one has always been at liberty to make architecture his hobby if he pleased, but then, whenever it has been taken up at all, it has been entirely through accident or fortuitous circumstances, and not in consequence of any provision made for the study in the usual course of previous education. The question, then, is, why has no provision of the kind been made? how happens it that architecture has been completely overlooked as a branch of education? And to this question no one, we will venture to say, is prepared with an answer, for the reason that no one has ever thought of its being ever asked. Shall we say it is because architecture has nothing whatever to recommend it as an elegant and liberal pursuit to those who do not intend to follow it as a profession? and because, although nominally accounted one of the fine arts, it has nothing in common with the rest, being, in fact, no better than a dry, plodding, mechanical calling, fit to be left entirely to those whose trade it is? It may be so; at any rate such is the light in which it is generally considered, though architects would fain have the world believe quite the contrary.

Let us disguise it as we may, the truth is, there is very little relish for art in this country; for instead of any pains being taken to instil a taste for it into young persons, they and all others are left either to pick up their notions of it as well as they can, or else to remain all their lives in a "gentlemanly ignorance" of it, while they find more congenial food for their taste in dandyism or politics, or on the turf and at the gaming-table—perhaps in amusements *à la Waterford*.*

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* It would not be amiss were we to look at some of the portraits drawn of us by foreigners. It was not very long ago that we met with a very long

> article in a German review which animadverted most severely upon our present extraordinary predilection for "mob literature," upon our Jack Sheppard and Oliver Twist mania, and upon productions of that Newgate school of literature which is calculated only to beget a low and scoundrelly sympathy with crime and vice:—an odd taste for a people who give themselves the airs of being the most moral nation on the face of the earth. Hardly more complimentary are some of the remarks we have met with in foreign publications, in regard to our feeling for art, and the mode in which we profess to encourage it. As far, too, as architecture is concerned, English buildings do not always make that favourable impression upon foreigners which it were to be wished they should do.

Whether this state of things is at all to be regretted or not, certain it is that we have no reason to be surprised at it; whereas it would be almost miraculous were we to find a strong love of art diffused throughout the public without any pains being taken to implant it, or there being anything in the present constitution of society to cherish a passion for art, as was formerly the case in this country, as well as others, when art was munificently patronized by the church. There is now scarcely any inducement for those who have leisure, to devote any of it to architecture as a recreative study, for they, no doubt, know that they would have very few to sympathize with them, and also that they may be wholly ignorant of it with perfect impunity.

Possibly the time—should it arrive at all—is not very far distant, when an acquaintance with the principles and elements of architecture will be considered nearly as indispensable as several other things that are now taught as accomplishments. At any rate it will be no fault of Mr. Wightwick's should such not prove to be the case, the primary object of his work being to gain proselytes to the study from among the educated of both sexes, although hitherto there seems to have been a kind of Salic law, excluding females from it altogether. Yet wherefore an art which depends so much upon the beauty of forms and their combinations, and the study of which tends so greatly to correct and refine taste generally, should have been considered unsuited for the female sex, or else far above their mental faculties, is one of those questions that when considered without prejudice, startle us by there being any occasion for putting them at all. There can be little doubt but that indirectly at least, female taste—or rather the want of it—has been more influential than is suspected, upon architecture; for almost one entire branch of the art has in consequence been exterminated—or rather checked and prevented from developing itself; that which should properly belong to the architect and the artist, being allowed to devolve upon the upholsterer. We cannot, however, allow ourselves to enter here upon a topic that would lead us on to a very great length, and shall therefore merely observe that architecture had been previously recommended as a very suitable study for females, both in the Foreign Quarterly and Loudon's Architectural Magazine; therefore supposing there is any absurdity in such view of the matter, it is not here broached for the first time by Mr. W., although his advice in that respect, will, no doubt, appear entirely novel to most of his readers. Whether so considered or not, we trust that it will not be altogether thrown away; and coming directly from a professional man, it may probably, have greater weight than it else would. So far from objecting to it ourselves, we could wish that the author had expatiated more fully upon this particular point, and had gone so far as to advise that those who have any inclination for the study at all should go through such a course of elementary lessons with an *Architecture-master*, as would familiarize them with all the technicalties of architectural drawing and detail, and thereby enable them to carry on their studies afterwards by themselves. Until an acquaintance with geometrical representation be formed, and a relish acquired for that as well as perspective delineation, little progress can be made in the pursuit; and although such mode of study may at first sight appear formidably tedious, it in fact opens a source of interest unknown to those who for want of such instruction see only general masses and forms, without taking any note of minor traits which confer individual character and expression.

Why then not call in the Architectural Master?—Because, people will say, it would be so very odd, and after all the acquirement itself would be a useless one, especially to ladies. This last ought of course to be admitted as a most reasonable reason; yet when we consider by how many exceedingly useless pursuits women now suffer themselves to be engrossed, that of architecture would be such a trifling peccadillo, that it need not weigh heavily upon their utilitarian consciences. It would seem, however, that there is at least one lady, and she too of high rank, who does not consider architecture—that is, the æsthetic or artistical part of it, either an unfeminine or a vulgar study; for as Mr. Wightwick has dedicated his volume to the Countess of Morley, we may presume that in her he has met with that example which has encouraged him to recommend the study to others of the sex. If it be true—but as we have only newspaper report for it, it is just as likely to be false,—if it be true, we say, that her Majesty is now taking lessons in etching, we hope she will, by and by, condescend to take some also in architecture, because there her taste might prove of singular benefit, and might encourage works that would redound to the credit of the age and of the nation, whereas her Majesty's etchings are likely to have just as much effect upon art as those of any other young lady—and no more. Had George IV. possessed a tithe of the taste for which he was so liberally credited by flattery, Buckingham Palace would have been a worthy architectural monument of his reign, instead of being, as at present, an ignominious one, and even Windsor might have, perhaps, been better by several degrees, than it now actually is. If there be any one of the fine arts which it is more especially desirable that a sovereign should be able to appreciate, it is surely architecture, because its more important productions are durable, and ought therefore to be noble, memorials of the period when they were erected.

If we have thus far said very little in regard to the volume before us, it is Mr. Wightwick himself who has diverted our attention from its contents generally, by adapting it to those who are without the pale of the profession, and by his endeavouring to enlist as many as he can into the volunteer corps of amateurs. And if we have confined our attention to this single point, it is because we consider it to be one of paramount importance, and perhaps go further in regard to it than even Mr. Wightwick himself, being of opinion that unless the public be educated to understand and relish architecture as a fine art, it is almost hopeless to expect that it should flourish among us. We may probably bestow some further notice on this work, but lest we should not do so, we will here express our hearty approbation of the writer's intention; nor do we entertain any doubt as to his book effecting considerable good.

A Treatise on Engineering Field Work. By PETER BRUFF, C. E. Second edition, corrected and enlarged. London: Simpkin and Marshall. 1840.

In our last number we took a cursory glance at the contents of this work, we shall now proceed to point out what is additional in the new edition: in the first place we must state that the whole of the work has been carefully revised, and that there are several passages distributed throughout, which did not appear in the former edition; we shall now confine ourselves to the leading subjects which have been introduced in the present volume.

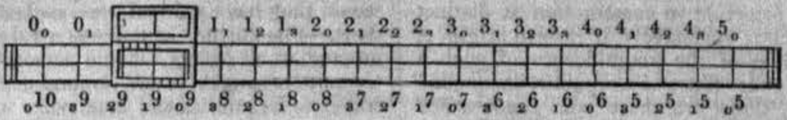
Chapter 3 is entirely new, and contains directions for conducting a survey, laying out a base line, a most important object in land surveying, and more particularly in railway surveying; for the latter we think it should be, if possible, marked out the whole length of the line by the engineer or his principal assistant, and that the connection of the work of the different surveyors should also be done by him. This chapter likewise contains some useful directions for the student in detecting and avoiding errors.

In chapter 4 we have some judicious observations on parish surveying, and remarks on Captain Dawson's directions for the surveys made under the Tithe Commissioners.

Chapter 5 contains instructions for surveying with angular instruments—town surveys and subterranean surveying.

In chapter 6 there are several hints for facilitating calculations, and various methods and instruments explained for that purpose; for our own part, we are generally averse to most ready reckoners, for in nine cases out of ten, if a person has any nouce, he will beat, by mental calculation, one who has recourse to tables and instruments, both in accuracy and time;—we, however, shall give the description of an instrument which, Mr. Bruff tells us, has lately been adopted in the Tithe Commissioners Office, and which appears to be an instrument not easily put out of order.

"The last, and most simple method, which we shall describe, and which is now in the course of adoption by all surveyors, and at present exclusively employed at the Tithe Commission Office, presents the greatest facility in performing computations, without in the least damaging the plans, by equalizing boundaries, &c., as by all the previous contrivances. The principle of the plan has long been in use by some few surveyors, but they prudently kept it to themselves, in order that the price of such work might not be reduced; but at last the method has become publicly known, and a vast reduction has taken place in the remuneration of such operations. In the first place, tracing paper of a superior quality is procured, and parallel lines, at exactly one chain apart, drawn in one direction only along the whole width of the paper. This paper is then carefully laid over the enclosure which is to be computed; the scale to which the map has been plotted is then laid on the first division of one chain—the incqualities at either end being equalized by the eye—and the distance noted. This first distance is brought forward at the second division, and the sum of the first and second at the third, and so on; thus, if the length of the first division is five chains, the scale, when applied to the second, is set on the left hand at five chains; and if the second division is seven chains in length, the right hand extremity is set to twelve chains, which quantity is again brought forward at the third division, and so on until the whole distance of a field, in strips of one chain, is ascertained, when the acreage is at once deduced, by cutting off three figures from the right hand—those on the left are acres—which are multiplied for roods and perches. An ingenious application of the above system is now in operation at the Tithe Office, by which means all calculation is avoided, and the area has merely to be read off on a scale. The following diagram and explanation will enable any surveyor instantly to practice it:



"The instrument consists of a box rule, with divisions at 2½ chains apart, and numbered 0_0, 0_1, &c.; at four of these divisions, or ten chains, it is numbered 1_0, or an acre—the reader bearing in mind that the divisions, on the tracing paper laid over the field to be computed, are one chain apart—therefore each single division, as 0_1, is a rood. There is a brass slider attached to the rule with a horsehair strained perdendicular to its length, for the purpose of equalizing the fences at the end of each strip. On this slider—which embraces rather more than two roods in its aperture—are laid off 40 divisions, on alternate sides, each way from the centre, and which are exactly the length of one rood, consequently each division is a perch. The figures on the upper side denote the acres and roods, as far as the rule extends, and are continued backwards on the lower part; the large figures are acres, and the small figures roods. Now, to apply this instrument to practice, lay the ruled tracing paper over the enclosure, and move the slider until its centre is on 0_0; place the scale in such a position that the horse-hair forms a mean line of such part of the left hand bounding fence as is included in the first strip of one chain wide, and press it gently on the paper; with the right hand move the slider along the rule, until the horsehair forms a mean line on the required part of the right hand bounding fence. Then move the instrument *altogether* on to the next division—the slider still remaining as last set—the horsehair forming a mean line, as before, with the left hand hedge; press the rule gently, and move the slider on the scale, until the horsehair forms a mean line with the right hand hedge, as before; which process is repeated until the entire length of the rule is passed over, when it is reversed, and the slider moved towards the left hand, the equalization in this case commencing first on the right hand side. When the slider is brought back to its original starting point, if there remains any further quantity, it is again moved forward to the right, as at first, the continuous measurement being easily kept up by the decimal arrangement of the contents. For example, in the position the slider occupies in the diagram—supposing it had been moved over the scale and back—the contents would be ten acres and 3 roods; and if, instead of the centre exactly coinciding with the division representing 3 roods, it was 20 of the small divisions on the slider beyond it, the contents would be 10 acres, 3 roods, and 20 perches. As a proof of the great saving effected by this instrument, we need only observe, that the price of scaling has been reduced from 50 to 75 per cent. since its introduction."

In our last number we stated that in this work, there would be found several useful hints, we shall therefore conclude by giving another extract, although it may not be new to the experienced practitioner, we have no doubt it will be found serviceable to the student.

"On the subject of reducing and copying plans we cannot be expected to say much. For ordinary purposes the pentagraph presents the readiest method, both for copying on the original scale, and also for reducing or enlarging the copy to any proportional size of the original. There are, however, several improved instruments for copying with greater accuracy than the common pentagraph admits of. The reducing of a plan by hand, is commonly performed by drawing squares of a size commensurate with its minutiæ all over its extent. Similar squares of any required proportion to the first are then drawn on the paper on which the plan is to be copied, and in every square of the copy is constructed that which is contained in the corresponding square of the original; to enlarge a plan the operation is reversed.

"A much more accurate method than the above for reducing or enlarging plans for railways or other similar purposes, is, to lay down lines of construction thereon, in precisely the same manner as would be done in surveying it; then take off the lengths, offsets, &c., with the proper scale, and replot the survey to that scale on which it is required. The usual method of copying plans by hand is to prick all the angular points and principal features through the original on to a plain sheet of paper fixed beneath it, on which the copy is to be drawn; these points being then connected—first with pencil lines—are inked in, and a tolerably accurate copy obtained: but the method is not to be recommended, from the injury it does to the original, and the incidental errors from oblique punctures of the pricker, &c. The best method of copying plans, which we are aware of, is either by a copying glass, or by tracing and transferring. That by the copying-glass is performed thus:—in a frame, which can be fixed at any inclination, is placed a sheet of plate glass; to the frame is fixed the original plan, and above it the paper on to which it is to be copied; the frame is then placed behind a strong light—or lighted candles placed below it—which enables the draughtsman to see all the lines of the original, and to trace them in ink on the plain paper without difficulty.* The second method is to make a tracing of the original on proper tracing paper; rub the back of it with powdered black lead, and fix it down carefully on to the paper on which the copy is to be made; then lightly trace all the lines with the end of a porcupine's quill, or other pointer which will trace fine lines, and a perfect copy similar to pencil will be obtained, which has then to be inked in."

We again with much pleasure recommend this work to the student, we think it the best practicable work that has been published on land surveying.

ON THE ORIGIN OF THE ARCH.

All must admit that any attempt to fix the date of antiquities is a dangerous task: that all who steer amidst the shadows of the past are subjects of suspicion and mistrust, is also true. Yet though I do seek the region of doubt, and, like the antiquary, revel for a little amidst problems and enigmas, I trust the importance of the subject may guarantee me in some measure from the fate predicted. In throwing out a few hints then, upon the "origin of the arch," wrapped as it is in mystery, it is not from an idea that to fix the period of its birth is vital to art, but rather that to assign to the relics and fragments of antiquity their proper age, seems virtually to guide us into the spirit of past times. Thus we shall be prevented from identifying much that is curious and singular in design, or grand in invention, with a barbaric æra; when a more civilized race might more consistently claim it.

Rome, we say, deserves credit for this invention, because Livy, in allusion to the "Cloaca maxima," remarks, that Tarquinius Priscus drained the low grounds of the city about the Forum, and the valleys lying between the Palatine and Capitoline Hills, by carrying sewers from a higher level into the Tiber. (Lib. i, c. 38.) But the drain was unfinished, and Tarquinius Superbus completed it, for he adds, "Tarquin the Proud made the great subterranean cloaca to carry off the filth of the city, &c. &c. (Lib. i, c. 56.)

Let us presume Livy to be correct, and that Tarquin really constructed that magnificent work; still we cannot conceal the statement of Herodotus and Strabo in their description of Assyrian monuments, &c. We may admit, perhaps, the cloaca maxima as a work of the Romans, but if Strabo be an authority, the arch was instrumental in the construction of the hanging gardens of Babylon, which must have been raised somewhere about 1200 years before Christ. Authorities may and do disagree as to the real author of those works, but that the pile of terraces was sustained by vast arches, raised upon other arches, seems indisputable. (Strabo, l. xvi, p. 738.) Then, again, as to the date assigned to them, whether we take Ktesias or Herodotus, still their date was very long before the building of Rome. Thus it follows that, if Babylon displayed the arch in her magnificent works, long before Romulus flourished, then Rome must (if she is to share in the discovery of its properties), at least yield in the *antiquity* of her claim to that of the Assyrian capital.

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* We have frequently practised this method in copying railway plans and sections in the country—using common window glass for the purpose, and found a great saving of time in comparison with the common method of pricking through.

Then another question arises out of this. Can the statement of Livy be correct? May not the cloaca maxima be as Ferguson hints in his Roman Republic, the relics of some great city, on the ruins of which Romulus pitched and settled. That the arch existed in Assyria is, as far as nice authorities are concerned, certain. That two countries might discover a grand principle in construction at distinct times, is *possible*—but that the arch is exclusively of eastern origin, is *more* than *probable*. To say nothing of the magnificence of such a work as the cloaca maxima, in the ruder times of a republic, unequalled as it was in the time of Augustus, there are those who countenance the idea of a city on the site of Rome long before the time of Romulus. Virgil alludes to this; for Evander, in speaking to Æneas, is made to say:

> "Hæc duo præterea disjectis oppida muris
> Reliquias veterumque vides monumenta virorum:
> Hanc Janus pater, hanc Saturnus condidit urbem,
> Janiculum huic, illi fuerat Saturnia nomen."—ÆN. viii, 355.

In another passage Virgil again alludes to this, and presumes it of Lydian extraction:

> "Ubi Lydius arva,
> Inter opima virûm leni fluit agmina Tybris."

In looking into the history of Lydia, we discover that Ninus, who married Semiramis (the probable author of the hanging gardens,) subdued the Lydians about 1232 years B.C., and it is probable that, when his second son Ezron became the king, the arts of Babylon might have crept after him, and thus the arch might have travelled with the Lydian colonists. Then, again, there are those who contend the arch was unknown in Greece till within a hundred years of the Christian æra. So that if Rome were its original source, it would seem much more reasonable to expect its application at an earlier period, since we discover the arch, even in China, in familiar and extensive use at a very early period.

Such are the doubts, I humbly offer to the curious antiquary, and without prejudice to the pretensions of Rome, would add, that there seems a disposition in us to fancy that great city to be the cradle of this important principle in construction, since in Rome we find its boldest application. Existing evidences, too, carry us back into times so remote, that we yield insensibly to this *material* impression, and hush all whispers of record and history in behalf of claims, when no remains of the past confirm them. Perhaps an abler hand than mine may yet clearly *prove* these suggestions, and discover Tarquin the elder, in his attempts to drain the city, as the finder of a hidden wonder, and not as the introducer of a novel discovery; whilst Tarquin the proud may appear only applying to the magnificence of Rome the skill of an earlier day—worthy, however, of praise for the ingenuity which detected, and the bold promptitude which applied it to the improvements of Rome.

FREDERICK EAST.

Sept. 10*th*, 1840.

THE NELSON MONUMENT.

THERE seems to be a pretty strong feeling entertained against Railton's Corinthian Column; and it is to be hoped that such a hackneyed and tasteless object will never be erected as a monument to Nelson, for in reality, it will prove a disgrace to Brittish art. Even at this eleventh hour it will be better for the parties more immediately concerned, to make the best of a bad bargain, and to put up with the loss of the money already thrown away, than obstinately to persist in completing an absurdity, because it happens to have been begun. The Nelson Committee ought rather to think themselves fortunate in having a very good excuse for even yet re-tracing their steps, and thus sparing themselves the obloquy, and art the discredit, that must else redound to them from such a puerile monstrosity.

Are we never to profit by experience, however dearly bought?—Must we continue to doom ourselves, time after time, to the sneers and reproaches directed against our blunders in nearly all matters of taste, by other nations?

Some may perhaps, be of opinion that quite enough has been said upon the subject already, and that any further remonstrance would be useless. We however, think very differently, being persuaded in our own mind, that it is mainly owing to want of determined perseverance in remonstrance, that so many abortions in architecture are inflicted upon this conutry. Or are we to be told that there is no public opinion whatever worth attending to in such matters?—that there does not as yet exist among us even one class of persons that can justly be considered as forming an architectural public? If such be really the case, the next question is, are we ever likely to have one?

As to the Nelson *bore*,—for such it now turns out to be,—there was, if we mistake not, a good deal said beforehand in the newspapers relative to the talent that would be elicited by the Competition. Talent, forsooth! Well, if there was talent, the Nelson Committee had certainly not *nous* enough among all of them, to find it out; else never would they have pitched upon such a miserable *pis aller* as they have done.—Should the Column—as we devoutly hope it will not—ever be erected, at all events a statue personifying the Collective Taste of the Committee ought to be clapped on the summit of it. Verily it deserves to be *extolled* and in no other way.

THE NELSON MONUMENT.

SIR—I am desirous of addressing you upon the subject of the proposed Nelson Monument; feeling that an unaccountable effort being now apparent to render our metropolis a laughing-stock to foreigners, it is a duty of every lover of art to raise his voice, however feeble, for the warding off of the impending calamity. I will for the most part confine myself to the examination of the question, whether an isolated column can with propriety be employed. Columns at first rude in execution, were erected by the ancients as actual supports to horizontal entablatures, and indeed according to one theory, that of Lebrun, we may say that their proportions, chosen as producing the most beautiful effect, were also those best calculated to ensure stability. The epistylia being of great length, the supports or columns were corbelled out at the top, with a view to shorten the part unsupported, and thus was invented the capital. It is erroneous, according to Sir William Chambers, and all other great artists, to employ ornaments which have not the semblance, at least, of utility, and if this excellent maxim be observed, we shall not admire a statue whose features cannot be distinguished, a capital without an architrave, and a column with nothing to support, and in fact, as I have heard it said, we might with as much propriety erect a colossal representation of the leg of our great hero. But, I am aware, there is yet a powerful argument in favour of isolated columns, viz. that they were employed by the ancients. But those who favour this opinion surely forget, that though in the columns of Trajan and Antoninus, the impropriety still exists, it is almost obscured by the ornaments and the spiral basso-relievos which, twining round the shafts, destroy in a considerable measure the idea of support. The object of the Roman structures could not be mistaken, they are evidently *monuments;* but the proposed erection will never have other than the appearance of a huge fac-simile of a small column. Surely some who argue that Roman precedent is sufficient to prove the proposed structure beautiful, pass over the numerous instances in which Roman artists have tortured and debased their plundered architecture. They it was, who totally ruined the proportions of the Doric and Ionic orders, who introduced broken entablatures and overloaded cornices, who placed order above order, and who set the order upon a lofty pedestal, and crushed it with a ponderous attic.

The truth of the saying of Aristotle, let us all hope will be manifested, and that "the people" will prove that they are the best judges of whatever is "graceful, harmonious or sublime," and I am confident that the best results would have followed, if *they* had been allowed, in the first instance, to give judgment between the competing designs. Amidst the general apathy, whilst the column is actually being commenced, an important Journal, Sir, like your's, should raise its voice, and you will therefore pardon, I hope, my trespass on so much of your space.

I am, Sir, very obediently, your servant,

A LOVER OF THE BEAUTIFUL.

47, *Lower Stamford-street.*

COMPARISON OF STONE AND BRONZE STATUES.

SIR—I observe with regret, that the statue for the summit of the Nelson column is to be of stone, from the very nature of that material it is impossible to make a statue which can look well in such a position, and this for reasons which I think have been overlooked, not only where statues of bronze have been placed on columns, but also in the majority of bronze statues erected in our public places. An error in judgment and in taste is observable in these, which becomes particularly offensive when a statue is placed on the summit of a column, and it arises from not considering the nature of the material employed. Bronze statues are, in our times, executed on the same principles of composition adopted in marble statues, from the necessities of the latter material. A glance at the arrangement of bronze statues amongst the ancients may assist us in determining what principles of composition should be followed; in these we find that trunks of trees, masses of drapery, and the various contrivances necessary to strengthen marble statues, and *only tolerated* because *necessary*, are entirely dispensed with, and where drapery is essential to the subject, it descends in peculiarly light folds, and is generally tighened round the ancles, every advantage of the material being taken to imitate the thinness of real drapery. There cánnot be a doubt of the propriety, and consequently of the taste of this arrangement, and an examination of the heavy dark masses in our streets and squares cannot fail to impress us with the conviction that the ancient practice is the proper one. The consequences where such masses are placed on the summit of columns, are peculiarly disastrous; it cannot, however, be doubted that bronze is the material which should, at all times, be adopted in such situations. We find, by the examination of ancient coins, that the statues of Trajan and Antoninus, placed upon the summits of their respective columns at Rome, were of a lightness in the arrangement wholly unattainable in marble or stone; these were clad in the military costume of their times.

The able artists who executed the statues of St. Peter and St. Paul now occupying (very incongruously, it is true,) the summits of these columns, had this difficulty to contend with, that their statues were, of necessity, enveloped in drapery; the talent with which the difficulty has been met is evident, and viewed at any reasonable distance, the statues look well. The drapery is arranged so as to be narrowest at the ancles, and the small perforation which it has been possible to take advantage of between the feet, has not been neglected, whilst the narrowing of the upper portion of the pedestals has greatly aided the grace of the general contour. It seems to me apparent that bronze is the only material which can enable the sculptor to make a statue fit in every respect for such a position; besides, to raise a monumental statue of so mean a material as that proposed, is altogether indefensible, placed on a magnificent column it becomes absurd; reason and good taste require, and the universal practice of the best periods of art point out, that statues in the position of that contemplated, should be of a more costly material than the pillar, which can only be considered its pedestal. The same reasoning by no means applies to the lions or sculptured portions of the column, as witness such ancient monuments as we are acquainted with, where the sculpture is merely intended as appropriate architectural decoration. In the Parthenon, the exterior sculptures were of marble; they only served to mark distinctly the character of the temple, the statue of the Deity within. The object, so to express myself, of the erection, was of far more costly material. The columns at Rome were decorated with appropriate and historic sculptures marking their character; the statues of the Emperors, the objects of the monuments, were of bronze.

I have some doubts whether the bronze columns which the French have erected are in good taste; they are imitations, or are designed on the principles of structures erected in marble. On the contrary, it has ever appeared to me that Bernini has displayed more philosophy and taste in his famous Baldachino in St. Peters, in having erected, as he has done, a light and peculiar structure, in which he has taken every advantage of the capabilities of his material.

When we look around us and see, I had almost said in every important city in Europe, monuments of the most magnificent description erected, it is with a feeling of mortification that we contemplate a proposed departure from propriety and good taste in our great and wealthy metropolis. I hope that an effort may yet be made to amend the resolution as to the statue. Should you think these few general observations worthy of a place in your excellent journal, you will gratify,

Sir,
Your very obedient servant,
C. H. W.

Edinburgh,
Sept., 1840.

CONSUMPTION OF SMOKE.

Sir—The possibility of ridding a large manufacturing town of the smoke which rises in such dense volumes from the long chimnies has always been a desideratum; but the methods employed to effect this have been so expensive or complicated, involving loss of power or extra labour, that they have been but little used, and the nuisance with all its disagreeable effects continues unabated.

Mr. Hall of this town has just patented an invention, simple, cheap, and effectual. I have this day witnessed its effects, and was much pleased with its simplicity, and astonished by the effective consumption of the smoke.

The principle of the invention, that smoke passed over a bright fire is consumed, has long been known; Mr. Hall only claims the adaptation of the principle which is thus effected:—

The fire place is divided lengthwise, by a thin wall of fire bricks, so that there is as it were two fire places under the boiler, each of which communicates with the main flue or chimney by a separate flue, therefore the two fire places would have no connexion were it not than an aperture is left at the top of the partition wall, near the front of the fire-places, by which means the two fires can communicate with each other, so that were the flue at the end of one fire closed, and the other open, the only passage for the hot air and smoke of the fire, whose direct communication with the chimney is cut off, would be through the aperture at the top of the partition wall, and over the other fire whose direct communication with the chimney is still open. It will be seen that by means of this arrangement the principle is easily applied. The fire, whose direct communication with the chimney is closed, being charged with fresh fuel, its smoke, in its route to the chimney, must pass through the aperture of the partition and over the other fire, which, being bright, effectually consumes it. By the time the fire last charged has burnt bright, the other will require replenishing, its communication with the chimney is therefore closed and the other opened, the low fire is charged, its smoke passes over and is consumed by the other bright fire. Thus by alternately charging one fire and then the other, all the smoke is consumed. The machinery for alternately closing the dampers is exceedingly simple. The smoke being all consumed a saving of fuel is obtained.

Whether the manufacturers will avail themselves of this invention, and thus materially improve the town, is uncertain; it is to be hoped they will; they ought at least to investigate the matter. One of Mr. Hall's furnaces is generally at work in Messrs. Brigg and Sons' mill in Carlton-street, where its operation and effects may be seen. The inhabitants of Leeds should not let this opportunity pass without making an effort to abate this nuisance.

Your's respectfully,
C. L. Dresser.

Commercial-buildings, Leeds, Sept. 16*th*, 1840.

COMMENTS ON PORTICOES.

Sir—When in his 'Remarks on Porticoes,' page 295, speaking of those which project across the pavement for foot passengers, A. W. H. says: "the beautiful portico of Hanover Chapel, in Regent-street, and those of the Haymarket Theatre, and Melbourne House, Whitehall, favourably illustrate this position," are we to imagine that he at all regards with a favourable eye, or intends to express himself in favour of, Nash's portico to the theatre abovementioned? If he does not, he has expressed himself most incautiously; and if he does, I for one certainly do not envy his taste, nor covet his compliments, since in my opinion that portico, in whatever direction it may be viewed, is a most vile and trashy piece of design. Its poor miserable and starved looking cornice—as meagre and shrivelled as that of the United Clubhouse,—would alone suffice to damn both the design and the designer.

If your readers are not so ultra-genteel as to shudder at those horrible vulgar things called proverbs, I would remind them of that which says "Fine words butter no parsnips," as being quite à propos to the occasion, for though that miserable affair in the Haymarket, is called Corinthian, its more proper title would be the Cockneyfied Order. With regard to the inner or back elevation, it would disgrace a modern Ginshop. I know not what A. W. H.'s ideas may be of a portico "gracefully breaking," the line of houses by projecting into the street; but I do know that seen in profile the Haymarket portico, presents a most ungraceful gap, looking as if a column had been there knocked out *pro bono publico*, so as to leave room enough for a half-a-dozen fat old ladies to walk through arm in arm.

As A. W. H. has condescended to mention St. George's, Hanover Square, —which is so little spoken of as a piece of architecture that we might fancy it to be some most obscure and insignificant church, not included within the 'bills of gentility,'—it is strange he should not have quoted that one as the very best instance of all where the footway is carried through the portico. A portico projecting over the foot pavement is it seems just about to be erected in front of the Adelphi Theatre; but it may with tolerable safety be predicted beforehand, that it will not be particularly ornamental to the street, since unless extended in front of the adjoining house on each side, it cannot be much bigger than an apple stall, and will perhaps look not much unlike an unglazed shop front, dragged forward before its neighbours.

C. C.

THE ARCHITECTURE OF LIVERPOOL.

By a Stranger.

In the following remarks, let it not be supposed that the writer is governed by prejudice or partiality, or "set down aught in extenuation or malice." He scarcely knows an individual in the town, and his visit has been but to add a little more to his stock of architectural knowledge, which, with a student's patience and perseverance, he has spent days in travelling and many nights in study, during nearly half his life, to obtain.

And first to the Custom-house. This edifice, uniting within itself the Post-office, and one or two other departments beside, is considerably larger, more imposing and magnificent, than its namesake in the metropolis, and yet there are many things deteriorating from its otherwise grandeur of appearance, and most painful to the practised eye of taste or travel. The principal front facing Castle Street consists of a quadrangle, the centre composed of a massive prostylar[*] octostylar[†] portico, the columns being copied from those of the little Ionic Temple of Ilissus, situated upon the banks of the river of that name in Greece. This portico is simple, grand, and expressive, and its large and chaste proportions beautifully adapted to its purposes. The proportions of the rest of the building are upon the same scale of plainness, simplicity, and largeness, I had almost said ponderosity of proportion, suitable to the extent and commercial nature of the building, where not elegance, but the substantiality and solidity commensurate to its objects are required. The plain portions of the buildings are adorned by pilasters, but the highly ornamental base, both of columns and pilasters, should never have been permitted to continue their corrugated torri[‡] round the edifice, thus disproportionately mixing richness and plainness upon the same face. The wings are simple and unexceptionable, and the bold, handsome stylobate[§] gives both dignity and elevation. But, upon carrying the eye upwards, it is most painfully offended by the unsightly dome and tambour upon which it rests. This excrescence is most truly unfortunate; firstly, the Greek character of the architecture did not require a dome, a thing utterly unknown to the Greeks themselves; and, secondly, the contour of the thing itself is both ugly and inharmonious. Had the architect, when he had resolved upon a dome at all, consulted the graceful simplicity, swelling circumference, and tapering outline of that of St. Paul's, London, his conceptions might have been more chaste, and his work less open to criticism. The circular heads to the windows are equally architectural anachronisms. The sides facing the Dock and Hanover Street, are adorned by a similar portico to that last described, and placed upon a bold flight of steps. Here the critic can only praise the pilasters, intercolumniations, entablature, cornice, windows, and doors; the latter, especially, are bold, handsome specimens. The rear elevation is most infamously miserable. The eye is pained and disappointed at the wretched poverty of ornament and detail; entablatures discontinued; two tiers of windows in one part, and three tiers in another, the upper one being beggarly loopholes in the place where the entablature should have been. The interior has also faults of no mean order; besides want of taste, the mixtures of styles, the commonplace, unimaginative nature of the details, it wants light. Still, upon the whole, in spite of many serious defects, this edifice, from its size, grandeur, chastened simplicity, isolation of position, and importance as to utility, is well worthy of admiration from the stranger, and respect from the citizens of the good town of Liverpool.

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[*] Projecting. [†] Eight columned. [‡] Circular portions of the base.
[§] Plinth or base, on which the building seems to rest.

Let me now turn to the Royal Bank, Dale Street, *i. e.* from the extreme of simplicity to that of richness and luxuriance. This edifice is just completed, and is composed of a basement of enormous height, upon which is placed a Corinthian order containing two tiers of windows. The centre is composed of seven-eighths columns. There is much richness and originality in this edifice, and although its gorgeousness and profusion of complicated carvings, mouldings, and details may please vulgar taste, it is too sadly overdone to please the more practised eyes of the architect or amateur. The basement is ridiculously high; the Venetian windows too redundant of carving and various ornaments; the cornices would not be too rich upon a plainer face, but now, cut dentil, carved ovolo, and running beads weary the eye, which, like the dove of old, finds no resting-place to fix upon, but, wearied and fatigued, it turns away, but is reluctantly compelled to own the extravagant richness and luxuriance of ornament. And yet, whilst some parts are more adorned than any building in the country, the central windows are mere loopholes, not having even an architrave round them, whilst the rest of the windows have not merely rich architraves, but revel amid a profusion of carved foliations. The top is surmounted by a balustrade, which, with the plinth, is ridiculously high. I would also call attention to the wretched life-size sculpturing of the arms in the centre of the building, which bears a distant resemblance to an amatory lion making love to some sportive unicorn, who, rejecting his addresses, and tossing up his head with its tremendous horn, seems to repeat to himself the scriptural piece of self-satisfaction, "My horn hall be exalted." Upon entering the interior, the eye is dazzled by the rich profusion of architraves, friezes, cornices, ceilings, panels, and ornaments; the eye is wearied and confused, and attention exhausted; no repose, no chasteness, all is the most lavish profusion. The grand error seems to have been to have crammed as much ornament and expense as possible within a given surface.

I will now turn to the Town-hall and Exchange. It is much to be regretted that the former does not face directly down Castle Street, instead of the portico approaching one side of the street considerably more than the other. This edifice is highly creditable for the day in which it was executed; and, although there are no great beauties, there is little actually to condemn beyond the meagre, wretched carvings between the capitals of the columns. The assembly-rooms are admirably proportioned, more especially the great room, which is in sesquilateral proportion, but the ornaments are somewhat few in number, and poor in detail. To the staircase, a later work, by Sir Jeffry Wyatville, must be afforded the most unqualified approbation. Its proportions, decorations, colour, and all other adjuncts, are beyond all praise. Its effect is that of the most chaste repose; and, of its size, there are few finer in the kingdom. Returning to the "place" forming the quadrangle of the Exchange, the stranger is much struck with the similarity of this, upon a small scale, with certain edifices upon the Continent. The effect of this square from one corner, with the Nelson monument in the centre, is particularly fine; for, although there is nothing worthy of note in the architecture itself, still there is an importance highly pleasing and effective. The monument is worthy of attention; the lost arm of this great hero is here ingeniously hidden by a flag. The base, which is circular, is ornamented by basso relievos and statues, full size, chained to the base, and resting upon a step, which gives a pleasing breadth to the lower portions. This adds much to the effect of the base; but whether it is worthy of the better feelings of humanity to commemorate our triumphs by figures in chains and painful postures, thus perpetuating the fierce passions of war, now that peaceful times are emptying their cornucopias around us, I leave to more philosophic critics.

EDER.

An enormous organ is now in the course of erection in the Abbey of St. Denis. It contains about 6,000 pipes, amongst which are some measuring 32 feet, and weighing 12,000 lb. This magnificent instrument is nearly completed.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

TENTH MEETING.—*September*, 1840.

(From the Athenæum.)

SECTION G.—MECHANICAL SCIENCE.

President.—SIR JOHN ROBISON.

Vice-Presidents.—His Grace the DUKE OF ARGYLE: Rev. Dr. ROBINSON (Armagh); Messrs. J. TAYLOR; J. WALKER.

Secretaries.—Messrs. J. S. RUSSELL; C. VIGNOLES; J. THOMSON; J. TOD.

Committee.—Messrs. J. Dun, T. Edington, W. Fairbairn, J. Glynn, Professor Gordon, Messrs. R. Griffiths, I. Hawkins, E. Hodgkinson, W. Jessop, A. Liddell, J. Macneil, R. Napier, Sir J. Rennie, Messrs. J. Roberts, J. Smith, C. W. Williams.

THE first paper read was "*On Safety-valves for Steam Boilers,*" By Mr. Galline.

The merit of the proposed alteration rested on the general principle, that the safety valves at present in use are not large enough; and Mr. Galline's object was to allow a large surface, like the lid of a chest, to rise when the pressure becomes sufficient to force it up; so that, on an accumulation of steam, it might escape, before any accident could take place. His proposal was, in brief, that a large valve shall open instead of a small one.

"*On extinguishing Fire in Steam Vessels.*" By Mr. Wallace.

Mr. Wallace proposes to effect this by steam itself. The plan has been some time before the public, and many successful experiments made in the presence of scientific persons. Among the most important was the following, made on board the *Leven* steam-boat:—On the cabin floor, a space of 10 feet by 14 was covered with wet sand, on which was laid iron plates and on these a fire was kindled with about 4½ cwt. of very combustible materials, such as tar barrels, &c. A hose 34 feet long, 2½ inches in diameter, extended from the boiler of the engine to the cabin, and when the fire had been sufficiently kindled, so that the panes of glass in the windows of the cabin began to crack by the heat, the steam was let in, and the door of the cabin shut. The fire was extinguished in about four minutes. Several trials were made, and all with like success. On another trial, a metal pipe of a greater diameter than the hose was connected with the steam-boiler, and extended into the cabin. A small square hatch was cut in the deck immediately above the cabin, and through this opening were lowered down into the cabin two moveable grates, each containing a blazing fire, well kindled, of about 1 cwt. of coals. The hatch on the deck and cabin doors were then shut, and the steam let in, and in 15 minutes the small hatch was opened, and one of the grates hoisted up, when the whole mass of coal and cinders, which had before formed a powerful fire, were found to be completely extinguished. This experiment was repeated twice with equal success.

In reply to a question from the President, Mr. Wallace said, that the hose might be made either or silk or canvas painted. It was stated that in Philadelphia, and now in London, the firemen always direct the water to the lowest part of the fire, that it might be converted into steam. Dr. Hamel, of St. Petersburgh, mentioned, that in Russia they have used woven hemp hose for fire-engines more than forty years. Mr. Roberts, of Manchester, said, that in that town there had been a fire in a factory some time since, when the men went in, broke the steam-pipes, which were charged, shut the doors, and the fire was out immediately.

"*On Wheels of Locomotive Engines.*" By Mr. Grime.

The rim or felloe of the wheel is turned, welded, and blocked in the usual way to the size required, say three feet diameter; the side, or front rim of the wheel, is formed out of boiler plate-iron, say ⅜ of an inch thick, clipped round to size required. I then, said the writer, take the plates and punch out the centre, which forms the eye of the wheel. After this the shapes are punched out, leaving the boss and arms standing together, with a sufficient breadth of iron at the extremity of the arms that will be equal to thickness of felloe, say 1½ inch to 2 inches, for wear, and, when welded, forms part of the felloe. The boss of the wheel is punched out of plate-iron, say ¼ of an inch thick, into what I denominate washers; I then pile them one upon another, to the breadth of the wheel, taking notice to cross the grain of iron every washer when piling them. By so doing, the boss, or nave, will be considerably stronger and tougher than if the grain of iron went all one way. When this is done, it bears the name of "faggotted iron." The washers being piled to the required thickness, I pin them to one of the punched plates, the diameter of wheel required; then put the rim or felloe on, and pin it to the plate. This being done, I put in the midfeather, say ½ inch thick, and the depth of felloe and piled plates or boss, there being in every washer a half circle punched out to receive the midfeather; the other plate is then put on, and pinned to the other parts. The wheel being now formed, it is taken to the furnace, which is constructed with a revolving table at the bottom, so arranged that it can be dropped or raised. This table is formed of fire-brick, and on the top are placed five loose bricks, to keep the wheel from touching the table, and to enable the workmen to get the wheel into the furnace and out again by means of a fork. The furnace having been got up to an intense heat, the table is set to a particular mark, the door of the furnace is raised, and the wheel slided on to the table; the door is then closed, and the table, which is worked from underneath by a tooth and pinion, is turned round, presenting every part of the wheel regularly to the flame, as the flame rushes through the furnace. The wheel, having been in about three-quarters of an hour, and having arrived at a perfect welding heat, the table is turned to the mark before mentioned, and the wheel is slided out on to an anvil. This anvil is planed perfectly true on the face, and is larger in diameter than the wheel. Above the anvil is the hammer, of about 15 cwt., suspended at a height of about 12 feet, the face of this hammer being planed perfectly true, to correspond with the face of the anvil. As soon as the wheel is placed on the anvil, the hammer is released, falls on the wheel, and perfectly welds it into one entire solid at a single blow. Before pinning the wheel together, I put the various parts into a solution of vitriol and water, and, should there be any part corroded, it immediately removes it, so that there is nothing but pure iron, and a good welding is easily obtained. The wheel, when cold, is turned up in the usual way.

"*On Warming and Ventilating Buildings.*" By Mr. Ritchie.

The principal object of this paper was to call the attention of architects to the construction of houses, with a view to a better provision for heating and ventilation. The author described the method adopted by Sir J. Robison, whose house is warmed by a large supply of air heated to 70°, which is allowed to issue directly into the lobby and staircase, which it heats to 60° even in the coldest weather. This heated air is allowed to enter the sitting rooms freely by concealed apertures over the doors, and the vitiated air is carried off through openings in the ceilings by separate flues in each room.

Mr. Hawkins always found that, in the sitting rooms, open fires were required to warm the feet, though not necessary in bed-rooms.—Mr. Hartop agreed, and considered Sylvester's Radiating Stove the best for the purpose, in addition to the general heating apparatus.—Mr. Vignoles concurred, and stated that nothing prevented Sylvester's stoves being universally introduced, but their high price.—Mr. Hawkins stated, that, from experience, a large fire with a small supply of air, was the most economical mode of using fuel.—Sir John Robison stated that, with the apparatus in his house, he can keep his staircase at a temperature of from 58° to 62°, when the current of heated air was only 64° as it issued from the apparatus, and that the additional expense caused by his provision for ventilation did not exceed 20*l.*

"*On the Temperature of most effective condensation in Steam Vessels.*" By Mr. J. Scott Russell.

Much (said Mr. Russell) has been said regarding the perfection of the vacuum formed in the condenser of a steam-engine, especially a marine engine. It does not appear to be known, that a vacuum may be TOO GOOD. We hear it boasted every day, by rival engineers, that their engines have the best vacuum. Some boast their vacuum at 27 inches, others at 28, others at 29, some at 30, and at last an engineer appears who boasts a vacuum of 30½ inches! It is to be regretted that time and talent should be thus wasted. It is a fact of great importance, and it is the result of theory, established on incontrovertible truth, and confirmed by experiment and by practice, that a vacuum may be too good, and become a loss instead of a gain. The truth is simply this, and should be known to every engineer: *If the barometer stand at 29½ inches, the standard of this country, the vacuum in the condenser is* TOO GOOD *if it raise in the barometer more than* 28 *inches of mercury.* This important truth is incontrovertible—it is practically exhibited every day. The following is a simple proof of this doctrine, divested, as far as possible, of a technical form, and put in the shape of an inquiry into the best state of a condenser:—

Let l=the caloric of water of 1°.
c=the constituent caloric of water in the state of steam.
e=the total force of steam in the boiler, in inches of mercury; and
x=the elastic force of steam at the temperature of best condensation, which we seek to discover.

Then from the law which connects the elastic force of steam with temperature, it follows, that in case of maximum effect, or the temperature of best condensation,—

$$\frac{l}{c}=\frac{x}{e}, \text{ that is, } x=\frac{e\,l}{c}$$

Now c is 1000; and if the steam in the boiler be at 5 lb. above the atmosphere, or if $e=40$ inches of mercury, and $l=1$,

$$x=\frac{40}{1000}=0{\cdot}04$$

Again, if the steam be at 7½ lb.=45 inches,

$$x=\frac{45}{1000}=0{\cdot}045$$

Again, if the steam be at 10 lb.=50 inches,

$$x=\frac{50}{1000}=0{\cdot}05$$

Hence we find, that the best elasticity or temperature in the condenser depends on the elastic force of the steam in the boiler.

With steam of 5 lb. in the boiler, the elasticity of maximum effect in the condenser is 93° Fah., and the best vacuum on the barometer is 28.

With steam of 7½ lb. in the boiler, the elasticity of maximum effect in the condenser is 95°, and the best vacuum on the barometer is 27·8.

With steam of 10 lb. in the boiler, the elasticity maximum effect in the condenser is 97°, and the best vacuum on the barometer is 27·6.

In like manner it would be found, that with steam of 50 lb. in the boiler, worked expansively, as in Cornwall, the best vacuum in the condenser would be about 26. on the barometer.

It is hoped, therefore, that engineers will not in future distress themselves at finding the vacuum of their condenser much less perfect than the vacuum of others who have obtained 30 and 30½ inches at so great loss of fuel and power. To obtain a vacuum of 29½, with the weather glass at 29·75, and steam at 7½ lb., would be to sacrifice four horses' power out of every hundred. In a day when the barometer is as low as 28½ inches, the vacuum in the condenser would indicate 26·8. In speaking of the vacuum in the condenser, it would save much ambiguity to indicate the elasticity merely of the steam in the condenser; thus, if the barometer stand without at 29½, and the barometer of the condenser at 28, it might be stated that the steam in the condenser stands at 1½, being the point of maximum effort. The indication would convey at all times more precise information.

Mr. Russel stated that the President had just put into his hands a communication in French on this subject from Mr. Barnes. Instead of a jet playing inside the condenser, M. Barnes allows it to rush in suddenly, and then stops it by a slide valve.—Mr. Fairbairn wished to know whether the facts stated by Mr. Russell had been practically established.—Mr. Russell stated how the experiment might be made.—Mr. Fairbairn considered this a very important subject, as bearing on the economy of fuel, and regretted that Mr. Russell had not given an account of his experiments.—Mr. Russell suggested that Mr. Fairbairn should himself undertake the experiments.—Mr. Hodgkinson considered it very important that experiments should be carried on; and Mr. Fairbairn, that experiments should be made on steam at all pressures. It was suggested that this was a proper subject to be inquired into by the British Association, and it was agreed that the Committee of the Section should discuss the propriety of applying for a grant to pursue the experiments.—Mr. Taylor stated that they use plungers in the air-pumps in North Wales; and Mr. Hartop, that in America air-pump buckets have been made without packing, and found to answer well.—Mr. Roberts stated that he had made engines with solid pistons without packing, both cylinder and air-pump.—Mr. Vignoles mentioned that such solid pistons had been used on some of the first locomotive engines on the Dublin and Kingstown Railway.

"*On Timber Bridges of a large size, in special reference to Railways.*" By Mr. Vignoles.

Mr. Vignoles commenced his remarks by stating, that he had, by permission of the committee, selected this subject for illustration and discussion before the Mechanical Section, from the notes of a work he was preparing for publication, 'On the General Principles and Economy of Railways,' his object in so doing being to elicit the opinions of his brother engineers, and to invite discussion and obtain information, but especially to direct the attention of all parties interested in the extension of the railway system to a principle of construction which, in many cases, would be found of great advantage in the economy and facility presented for overcoming obstacles, otherwise insurmountable, within reasonable limits of expense. Mr. Vignoles took a rapid view of the history of timber bridges, tracing their first erection in Germany, then through the United States of America, and back to Great Britain. He also described the difference between the principles of large bridges constructed with baulks and half-baulks, and of timber arches, formed of layers of plank laid over each other, and fastened securely together, and, with felt or other means, to make the joints and beds wholly impervious to water. Mr. Vignoles stated, that the first bridge on this principle in Great Britain had been erected at some place in Scotland, by an ingenious mechanic of that country, whose name he regretted not to be able to state. This was many years since. The principle had been also made known, particularly of late years, by the timber viaducts erected under the direction of Messrs. Green and Son, of Newcastle-on-Tyne, who had been built several, and had designed more; and Mr. Vignoles further explained, that Mr. Nicholas Wood, of Killingworth, who at this time erecting, for the Duke of Buccleugh, a timber viaduct, of great height, and with large openings. Mr. Vignoles disclaimed any intention of discussing the question as to whom the merit of orginality belonged, and observed, that he, at present, purposely refrained from any details, as these had been entered into by Mr. Green both at Newcastle and at Birmingham, reserving any remarks on such details for a future occasion, should it present itself. Mr. Vignoles then explained the peculiar applicability of timber bridges or viaducts to the passage of deep ravines, so often met with in hilly and mountainous districts, illustrating his remarks by diagrams. The communications, for example, to be made between the north of England and Scotland would probably have to be sought along some of the valleys leading to the passes through the Cumberland Hills, and here, as in many similar districts, engineers in the habit of considering such lines well knew, that many miles of favourable country for roads or railways were often to be obtained along the sides of such principal valleys, until some unavoidable appalling obstacle appeared in the passage across some of the lateral openings or ravines. Instances had and might occur where the whole of such a line, otherwise highly desirable, would have to be abandoned, unless some economical construction were devised to surmount the difficulty: and here the timber viaduct would most advantageously be introduced, since many feet additional height in the level of the railway would add but little to the expense. He then instanced several places of formidable height, and of various breadths, where he had already designed, or knew of the applicability of such constructions. In reference to the expense, he stated, that it was chiefly when extraordinary height and either one arch of great span were required, or where a series of arches, of large openings, were wanted or could be introduced, that the timber viaducts were the most economical. In ordinary heights of 50 or 60 feet, and with arches of less span than 100 feet, and particularly in countries presenting facilities for construction of stone, these latter would be undoubtedly preferable; but when the height of the construction became great, the great expense for the centering for arches of masonry, and the multiplication of the number of piers, in order to keep the span of the arches to a moderate size, greatly increased the expense, and threw the balance vastly in favour of the timber. Mr. Vignoles instanced the Ribble Viaduct on the North Union Railway (a model and description of which is in the Model Room of the Association), which was about 50 feet high, with five large arches, of 120 feet span, and had cost 60*l.* per lineal foot; whereas, in another place, a timber viaduct, of 140 feet high in the centre, and averaging 100 feet high, with arches of 130 feet span, and extending for a length of nearly 2000 feet, was proposed, which would not exceed in price 20*l.* per lineal foot, the breadth of roadway being, in both cases, 28 feet for a double line of rails. Mr. Vignoles stated, that in extending lines of railways through the west of England to the packet stations, through the mountains of Wales for a communication between London and Dublin, and through many parts of Ireland, along the lines laid out by him for the Government Railway Commissioners, the timber viaducts would, from their cheapness, enable the works to be entered upon, which the great cost of stone would quite forbid; and he concluded by calling on his fellow engineers to turn their attention to this while laying out new lines, and to take bolder steps across the valleys, relying on the timber viaducts to accomplish their objects.

Mr. Blyth thought that Mr. Vignoles had over-estimated the expense of stone, which Mr. Blyth knew had been executed at about 25*l.* per foot.—Mr. Vignoles replied, that it was seldom that stone could be had at so small an expense; when the span is large, and the height great, it is much more costly.—Mr. Smith, of Deanston, agreed with Mr. Vignoles, but did not think that planking was the best method, as it would not stand so long. A wooden bridge should be so constructed, that any decayed part could be taken out and replaced.

THE THAMES EMBANKMENT.

THE SELECT COMMITTEE appointed to consider the PETITION of the CORPORATION of LONDON relative to the Embankment of the River Thames, and to report their observations and opinions thereupon to the House, together with the best means of carrying the same into effect; and to whom several Petitions relative to the measure, and Reports of former Committees, were severally referred;—have considered the matters to them referred, and have agreed to the following Report:

The Committee have met and proceeded to examine a Plan and Estimates of the proposed Embankment, submitted by Mr. Walker and Mr. Higgins, and other witnesses: that several petitions for and against the measure having been referred to the Committee by the House, and many other witnesses both for and against the intended plan being proposed to be examined, the Committee are obliged, by the near approach of the prorogation of Parliament, to conclude the inquiry without the examination of many plans for the embankment of the river, or the consideration of any plan for the improvement of the navigation, without any alteration of the present line of embankment. Upon the general subject, therefore, of the improvement of the navigation, with or without any embankment, they give no opinion in the present state of the inquiry.

29 *July* 1840.

ABRIDGEMENT OF THE EVIDENCE.

James Walker, Esq., was examined and stated that he has been professionally acquainted with the river Thames, in reference to the subjects of inquiry, for the last 30 years he has been employed, either as assistant or principal engineer, at the greater part of the docks that have been constructed in the port of London. In 1816 he constructed Vauxhall Bridge, and in 1821 his attention was called directly to the effects that the then proposed removal of London Bridge would have on the river Thames. He has been almost constantly employed on works of a similar nature on the Thames from that time to the present day. He was called in by the committee for letting the Bridge-house estates in 1821, along with his friend Mr. Leach, to report on the effect that the removal of London Bridge would have on the water of the river Thames. He did not think that ballasting has done much good; it is done for the purpose of obtaining ballast, and it is only where the ballast is good that the dredging engines have got to work; that has not much regard to the interests of the navigation. It does nothing to take away the shoals. At present the water ebbs so low in the river, above bridge, that in some parts of it, where the width is very great, the shoals are perfectly dry for the greater part of the width across the river; mostly in that part of the river above Waterloo Bridge and the neighbourhood: between Westminster and Waterloo Bridges and below. The dredging vessel above bridge is used chiefly for obtaining gravel for roads, not for ballasting ships and similar purposes. The effect of the removal of London Bridge operating in the way he has stated, increased the velocity of the current through Blackfriars Bridge, and had nearly undermined the piers; so that by going down, which he did in a diving helmet, he could put his leg under the caissoon bottoms, under the platform on which the bridge stands; the consequence was that the city, partly through that cause, and partly through the decayed condition of the stone, ordered a survey to be made, and an estimate; and since that time, five of the piers have had coffer-dams put round them, and the foundations extended down to about 14 feet below the old bottom, as regards Westminster Bridge, although a great deal of trouble had been taken for a great many years in supporting it, the Commissioners of Westminster Bridge, also for the same reason, have commenced strengthening the piers in the same way as has been done at Blackfriars Bridge, by coffer-dams; he considers that both of them are the effect of the removal of London Bridge. He did not think that any increase of ballasting would prevent the accumulation and increase of shoals, because while the river is so unequal in width as it is now, you may keep ballasting, but the velocity being slow at the wide parts, you will have a settlement always taking place there again, and then you must go on constantly with the ballasting. The first thing to be done is to regulate the width of the river. The plan of the river which is before you will show you, that in places now between London Bridge and Vauxhall Bridge the river is double the width that it is at other places. The effects by London Bridge being removed since 1821, are what he has before described, to deepen narrow places very much, and to cause large shoals in the places where the river is so very wide. To give the Committee an idea what the present width is, he stated, that the width now opposite the Penitentiary is 600 feet at high water; opposite Millbank, to the Bishop's-walk, it is 1,050; opposite the Board of Control it is 1,200; and opposite Buckingham-terrace it is 1.480. Then it keeps narrowing by degrees, until below Southwark Bridge it is 720, and at London Bridge the waterway is 690. While the river is so unequal as that no dredging would do much good. If you dredged so as to get proper depths for navigation in the wide parts, you have a settlement of mud, and a constant removal of that again, or an accumulation of shingle to fill up those cavities. The idea here was, first to endeavour to get something like a regular section, not strictly increasing in width by degrees, but approaching to it as far as could be done consistently with the value of the property on the sides of the river. The waterway of Vauxhall Bridge itself is 702 feet; the width of the river 200 or 300 yards above is 680 feet at high water, between the wharfs. He does not consider the whole of that waterway useful for the purposes of navigation as a thoroughfare, but it is for the general purposes of trade, that is to say, that the barges can go up to the wharf-side, and can go away again at high water at all times. There was an apprehension that the present embankments that have been carried out, such as that one at the House of Commons and others, would have left in the parts of the river near it a considerable quantity of mud, and the proprietors of property above bridge had a clause introduced into the Act for building the Houses of Parliament, keeping open their claim for compensation in case of damage being done. He has, from time to time, as employed by the Commissioners of Crown Lands, sections taken of the states of the ground at different times, and the fears of those parties have proved to be very much over rated; the increase is not so great as he expected. The increase is very variable; perhaps in some places it is lower, and in other places higher, but as a general position he does not think there is much increase. There are now deposits in consequence of the embankments. The coffer-dam around two of the piers of Westminster Bridge tended to send the water over to the opposite side, and to cause a settlement of mud on the Middlesex side: that coffer-dam is now removed, and the opening which was closed by the coffer-dam is deeper and better than ever it was. The deposits have been between high and low-water mark. The effect, opposite the projection itself, is to decrease the deposits by narrowing them; but the effect also is to cause the settlement of mud above and below. The effect that would otherwise be produced is much lessened by the constant passage of steam-packets up and down the river. The mud is kept in a state of suspension instead of being deposited. What the embankment would have tended to have done has been prevented or removed by the wash of the steam-packets. The removal of the coffer-dam from the western arch of Westminster Bridge will tend to remove the deposit that has taken place in the course of last year, and when the coffer-dam in front of the new Houses is removed (which it will be when the Houses of Parliament are finished), with the large quantity of ground which he had put out for the purpose of securing the coffer-dam, that will tend to bring the current over to the Middlesex side. He hopes the effect of continuing the embankment will be, if properly done, to remove the shoals. The idea would be, whether by embankment or otherwise, to deepen the river by the removal of the shoals, and to apply those shoals to filling up behind the embankment. He contemplates two operations, both deepening the river artificially and building the embankment; the embankment could not be made without the material which will be taken from the bed of it to fill in behind the embankment, which will have the effect of deepening the river. Deepening the river, the supply of water remaining the same, will tend to throw a greater quantity of water within a certain part of the channel, but it will not be at the expense of that side of the river where there is no embankment; the embankment being to be formed close up to low-water mark on the north side. There will be more water on the south side than there was before.

Mr. Walker explained that it is not only the land floods coming down, that chiefly forms the current of water in the river Thames opposite Lambeth; but it is also owing very much, except in extreme floods, to the tides. Now, whether it be from tidal water, or from land floods, the effect of narrowing the river on the north side would be, as there is a given quantity of water to come down during the land floods, to press that water more over to the south side, and to increase the velocity. With land floods the quantity is given; that is to say, it is fixed, whether the opening be large or small. With regard to tidal water, it depends on the space to receive the tidal water; but the effect in any way would be to give greater velocity, and tend to the removal of mud from the shoals on the south side. Where the river is very wide and straight, there is a very considerable quantity of mud, three, four, or five feet and more; at other places, at Waterloo Bridge, for instance, although the width is very great, there is not so great a quantity of mud, because the flood-tide rather takes that off. Mr. Walker stated that his evidence given referred to one side of the Thames only. The ultimate scheme is to embank both. It may be done with one side only, but not so complete as with both sides. Although he uses the word embanking, the Committee must not understand that there is an intention, or that it is practicable to embank both sides of the river by walls from side to side, but that every respect must be paid to the way in which the present premises are occupied, still improving the navigation, and the value of the property. There is a large space occupied now by coal barges, some on the opposite side by barges with timber. There may be places where, by carrying out the embankment wall, the trade may be so much interfered with as to damage the property, unless provision be made in the proposed improvements for accommodating those barges. He proposes to place the barges alongside the wharfs, and extended a great way out, and to lie on their beds as they do now; but still the river, as regards the navigation, and as regards the health of the town, and he thinks as regards the property itself, improved. The area of the river would be diminished where it is too wide.

The effect of the removal of London Bridge on the sewerage has been to expose a larger surface of the bank of the river at low water, and to render, therefore, the injurious or unpleasant effect from a discharge of the sewers greater than before. The effect on the bottom of the river generally has been to deepen it in certain places, and to render it shoal in other places very much, as he ascertained, and as he read from the report of 1821. He thinks it is quite impossible to look at the river Thames, at low water now, without seeing, as regards the trade up the river, and the navigation opposite to London itself, that the river is in a state that wants improvement very much; and this is to be taken along with it, that as the effect of all those floods is constantly to deepen in one place, and to shoal in others, that that deepening will extend in time, so as to be injurious to the property on the banks of the river, as regards its foundations. He thinks the river will undergo further change. The effect of the dam at London Bridge was to keep the bottom, above London Bridge, very much higher than below London Bridge; the dam is now removed, and there is, as was predicted by Mr. Smeaton, a constant movement of the bottom of the river downwards, and an increase in the depth in certain places; and that will go on for many years to come, perhaps generations. The effect on the water-side property, if continued without some protection, may be, as he has already said, to endanger the foundations of some of the best buildings on the river Thames; I refer to the great current in one place, and to the forming pools in the middle of the river, which tends to draw the sand from under the buildings on the banks of the river. It would be desirable, in his opinion, that the bed of the river should be made uniform, or nearly so, in point of depth, and gradually increase in width from Vauxhall Bridge downwards.

The calculation which has been made for forming the embankment has been, in the front of the private houses, where the embankment is to be made, built of brick and filled behind with the excavations from the bed of the river; the Government property in the neighbourhood of Whitehall, and also Somerset House, has been estimated to be faced with stone. He has no hesitation in saying that this embankment would improve the navigation throughout; there is no way, he contemplates, in which any person could say otherwise, excepting this, that where the embankments are made there is a small decrease of tidal water, somewhat less of tidal water comes up the river than would before, referring to width only, and therefore a somewhat smaller velocity of the ebbing tide; but that would be partly compensated for by the deepening. He has seen this done under his own directions on the river Yare, and the effect has been good, both as regards the harbour from the removal of the bar, and the improvement of the navigation up to the town; that was done not by embankment wall, but by a dwarf piling, exactly as the section now before the chairman shows it. Extensions into the river Thames are sanctioned, and their extent defined and regulated, by the navigation committee of the city of London. The proposed width varies from 600 to 800 ft. If the conservators of the river think that barges can lie without prejudice to the navigation or highway, they may lie in the river afterwards just as they do now; but if the embankment be carried on, and these recesses left, both as regards the current of the tide, and as regards being injured by other barges, those docks would be snugger than the barges lying out in the river. Injury may be done to the individual by not allowing him to go far enough into the river, or injury may be done to the river by allowing him to go too far, unless a general plan is laid down and acted up to. When one embankment is carried out, or a wharf carried out beyond the other, great inconvenience arises to both of the parties; and it is a constant source of quarrel in the river Thames at this moment; one party opposing the embankment and another supporting it; and he takes it the members of the navigation committee itself are much annoyed by individual applications, they themselves having no certain rule to go by. He proposes that the allinement should be general; it should be either an embankment or a dwarf piling, to regulate the section of the river. He need hardly say that his answers must be very general; but in a great work, such as this, reference would be had to the interests and wishes of the individual parties who have property on the banks of the river, and their wishes complied with, so far as that can be done without prejudice to the great public measure; and if that were done, he thinks benefit would be done to all. These recesses would, in degree, be injurious to the general plan of regulating the velocity of the river, and the less of them the better; but as they would be recesses with their sides at right angles with the line of the river, their effect would be far less injurious than gradual widenings and narrowings. He presumes that the only way the thing could be done practically, is to consider these recesses, as well as the back ground, private property after the works should be complete; he thinks it impossible to introduce any occupier or proprietor between the present bank of the river and the proposed embankment. His idea is, that all the ground reclaimed should be considered as belonging, upon terms to be agreed, to the owner of the adjoining property. He considers that the property on the banks of the river will be improved in value by the alterations; he does not mean to say there may not be some exceptions, but he thinks very few; and it is impossible, in a great work like this, to have good done to all without some injury, perhaps, to individuals. He has estimated for a brick wall, generally; but, in some places, stone; he considers all the answers he has given now to have reference to the north side of the river.

The whole length of the embankment, between Vauxhall and London Bridge, is 11,055 feet, which is exclusive of the part that is not intended to be interfered with. The length he has given terminates at Dowgate Dock; that is the whole length he proposed embanking on this plan. There has since been, he has been informed, applications made by the owners of property below to extend it farther, nearer to London Bridge. Dowgate Dock is about 1,000 feet from London Bridge. The 11,055 feet includes not only the portion he proposes to embank, but also those recesses which he proposes to leave for the accommodation of the trade. The total distance from Vauxhall to London Bridge is 15,900 feet, according to the present line of river frontage; his whole estimate is £310,000; £105,000 of that, as far as he can ascertain, is crown property. He thinks 2*d.* per foot per annum would cover all the expenses of the cost, with moderate additions for contingencies, expenses of management, rent, &c. He considers that the mud so carried away would not be deposited in a still more important part of the river, in the Pool, for instance. There would be a diminished quantity of tidal water, but that would be compensated partly by increased depth, by removing the shoals which now appear above low water, and would be more than compensated by making the bed of the river of a uniform character both in breadth and depth; at present there is a rise at low water from London Bridge up to Westminster Bridge of 2 ft. 5 in., the water being kept up by the shoals in the way described; if the river were regulated and deepened, the effect would be to lower the water at Westminster Bridge, and all the way up the river lower than it is now; therefore in depth there would be a greater quantity of tidal water to ebb and flow, which, he apprehends, in cubic quantity would exceed the contents of the embankments. The width of the river when the embankment is done, with what is its present width at those points, will be as follows:—at the Penitentiary no diminution is proposed to take place in the 600 feet. From Millbank to the east end of Bishop's-walk is intended to be reduced from 1,050 to 800 feet. Opposite the Board of Control it is proposed to reduce it from 1,200 to 840 feet. Opposite Buckingham terrace, from 1,480 to 850 feet. Opposite Somerset House, from 1,250 to 870 feet. Opposite Temple-stairs to Lett's timber-yard, from 1,240 to 870 feet. Opposite Whitefriars-dock to Bull-stairs, from 1,040 to 770 feet. From Trig wharf to the opposite side, from 920 to 730 feet. West side of Queenhithe dock to opposite side, from 700 to 680; after which the diminutions are small, and the river gets narrower.

(To be continued.)

STEAM NAVIGATION.

STEAM NAVIGATION IN FRANCE.

Extracts from the Report of Count Daru to the Chamber of Deputies, in the name of a Special Commission intrusted with the examination of a projected law relative to the establishment of Steam Packets between France and America.

The form, dimensions, and power of steam-boats evidently depend on the service to which they are destined. They were not long merely employed in the ascent and descent of rivers, but soon the limits of steam navigation were enlarged, increasing the power of the engines from 20 to 80, 160, 200, and 250 horses, it became possible to extend the field of their employment to venture on the sea with them. Towing boats, which had been constructed in a few ports, soon threw a light on the superiority of the new system, by bringing out large vessels, weather bound and condemned to inactivity, and drawing them in their wake with a facility which seemed to defy the elements. From that day the bright days of sail-navigation, which, till then, was looked upon as the *chef d'œuvre* of human understanding, were eclipsed. Now vessels were started on every coast. Regular and rapid communications linked together every important town, such as Havre, London, Dover, Hamburgh, Rotterdam. This was the forerunner of more daring attempts.

In 1819 a vessel from the United States, "the Savannah," had crossed the ocean from Liverpool to New York, partly by wind and partly by steam. America, then, had the lead again in daring to apply Fulton's machine to long voyages, and this is the more remarkable, that it has always had but few steam-boats on sea service. This first essay was not repeated, until, in 1835, when the English undertook the passage from Falmouth to the Cape of Good Hope; the Atalante, provided with an engine nearly similar to that of the Savannah, accomplished in 37 days a distance of 2,400 nautical miles. The Berenice, the Medea, the Zenobia, performed passages of different lengths on the coast of Africa, and in the Indian seas. All these boats were English. In the Mediterranean, steamers of different nations, Neapolitan, Sardinian, Austrian, French, crossed from one port to another. Lastly, our service of steam-packets from Marseilles to Alexandria was established, and threw open to us a new access to the East. The passage to Constantinople, which was sometimes 45 days in duration, was thus reduced to 13½ days.

These numerous experiments gave rise to the idea that, by the aid of steam, it was possible to accomplish the distance between Europe and the United States. The difficulty of carrying the necessary quantity of coals for the consumption of an engine acting, without interruption, from one shore of the ocean to the other, during a space of from 15 to 20 days, was no longer an obstacle. It had been discovered that the consumption of combustible did not increase in the same ratio with the power of the motors,—that an engine of 250 horse power, for instance, was far from burning twice as much fuel as was necessary for an engine of 125 horse power; that, moreover, certain parts of the mechanism might be simplified in such a manner as to take up less room, and consequently, leave more space at disposal for the accommodation of passengers or merchandize. From this time operations were commenced, and on the 4th of April, 1838, the first experiment was tried. You are all acquainted, gentlemen, with the result. You all beheld the enthusiasm excited by the success of the voyage undertaken by the Sirius, 15 days had been sufficient for its passage. Scarcely had this vessel arrived in the port of New York, when it was joined by the Great Western, which started from Bristol on the 8th of the same month, after a passage of 14 days.*

Henceforth the problem was solved. America was nearer the European continent by half the distance which formerly separated them. There could be no more doubt concerning it; the events which have since occurred have ratified these first expectations.

The Great Western has crossed the Atlantic 28 times during the period of the 14 months just elapsed without accident, maintaining an almost uniform speed, of which the average time was 16 days going, and 13 to 14 days coming back: the last voyage was even accomplished in 11½ days.

During two years since they began their operations, with what strides have the English advanced?

A first line from Bristol to New York was established in 1838. The company to whom it belongs has four steamers of 450 horse-power—namely, the Sirius, the Great Western, the Royal William, and the Liverpool. The price of each of these boats is 1,300,000f. It is said that they now are building an iron steamer, which is to carry two engines, whose united powers will amount to 1,000 horses. These engines were constructed on the plan of Mr. Humphreys; the boat will only be 100 meters in length, and will have room for 300 passengers, and a considerable quantity of merchandise. The works are in active continuation, and will be terminated, according to appearances, in the course of the year 1841.

Another line was established for the service of London and New York. Two vessels were employed on it—the British Queen and the President; the engine of the British Queen was of 500 horse-power, that of the President 600; they can accommodate from 225 to 250 passengers, and receive a load of from 500 to 600 tons. A third line connects New York to Liverpool, so that there are already three establishments sending steam-vessels from different parts of Great Britain to the United States.

Moreover, a compact was sealed on the 4th of July, 1839, between the Admiralty and Mr. Samuel Cunard for the transit of letters from Liverpool to Halifax. Mr. Cunard has engaged that there should be two departures per month, and receives from the Government an annual remuneration of 1,500,000f. The Britannia, of 450 horse-power, was launched into the sea in the beginning of February, 1839.

Lastly, a more extensive service will soon connect Great Britain with the West India islands: there is a company in existence under the name of the Royal Steam Navigation Company, which is preparing vessels for New Orleans, Mexico, and part of the South American coast. This company the Government indemnifies by an annual payment of 6,000,000f.

You must all perceive, gentlemen, that we must not delay entering into the lists, for we are urged on by competition from every quarter, and the appearance of English steamers on every point of the New World to the exclusion of our own would soon banish us from those regions.

However serious the character of these motives, gentlemen, they are, however, secondary when compared to a consideration which we will not endeavour to conceal. The navy is a weapon, and one which to all appearances is destined to play an important part in the conflicts which a future day may bring to light. Attempting to foretell what consequences may be reserved for a future period by the introduction of steam in constructing ships of war would be presumptuous; it is a question of entirely recent origin; experiments with regard to it are in their infancy. It is, however, already discernible that the use of new motors will infallibly produce the following effects:—In the first place, it will render every vessel in similar conditions equally supple and tractable, by whatever men she may be manned. It will be sufficient to have able engineers in order to effect manœuvres with a facility and precision as entirely independent of the state of the sea as of the greater or less aptitude of the sailors.

Secondly, the number and proportion of the men required for the performance of the ship's duty would be entirely changed. The Great Western, whose form and dimensions are nearly those of an ordinary frigate, is conducted by 50 men, including engineers and stokers. Now, if it be true that the naval enrolment of France is incompetent to supply all its necessities, this inconvenience will vanish; and the more so, because the zone in which we shall be able to find men fit for the service will be extended.

Lastly, the draught of water occasioned by a steamer depends upon its power; but for all it is less than that of ships of war. Whence it follows, that instead of the five or six ports to which our vessels and frigates can resort, steam-boats will be able to cast anchor off any coast, and, so to speak, in any bay.

Thus the new vessels provided with a good engine will be swift, will offer less hold to the enemy, will have a greater number of safe harbours to resort to, will require a less numerous crew, and require less previous apprenticeship than in sailing vessels. This will evidently become a new weapon; and if these ships carry guns for the discharge of bombs of a recent invention, whose effect is such that at one discharge they are capable of disabling the largest craft, they will become a weapon at once easy of management, safe, and of the most destructive nature. Is there not wherewithal here to change the whole direction of naval tactics, all the proportions existing between the powers of nations? Here is an entire revolution. Slow or fast, partial or complete, this revolution will ensue. Now, with the example given us by a Government whose energetical endeavours are dedicated to the continued increase of its naval resources, when we see Great Britain during two years continually multiplying, at the cost of such enormous sacrifices, its steam navigation, and finding in the gigantic establishments of its industry those inexhaustible resources of which we are deprived, would it be wise, would it be prudent to continue our *materiel* in its present state, to abstain from making some progress in the new career which has been traced out to us? Undoubtedly we do not indulge in the chimera that our country can ever equal the English in their naval establishment. The strength of the British nation rests entirely on its foreign trade; they are an exclusively seafaring nation. All the springs of its prosperity are there; it drags after it that colossal superiority which constituted at once its greatness and its peril. The conditions of existence in which France is situated are different; but the extent of its coast, its position, the genius of a portion of its inhabitants, compel it to possess a navy, and in that case it is becoming that, wherever she may be pleased to hoist her flag, she may be enabled to assemble and display a sufficient force in order to insure respect. Without this she could never effectually protect her national interests beyond the seas.*

The construction of steam-boats for transatlantic voyages presents, then, a double object to our view. Applied, in time of peace, to the growth and preservation of our commerce, they may be transformed, during hostilities, into ships of war; they may assume, in turn, the double character of a defensive weapon and of a means of conveyance—of a commercial and of a military navy; to-day they may carry merchandise, and when requisite guns

STEAM PACKETS TO CONVEY THE MAILS BETWEEN FRANCE AND AMERICA.

We, Louis Philippe, King of the French, have proposed, the Chambers have adopted, we have ordered and do order the following:—

Article 1. A line of steam-packets shall be established in order to convey the mails between the ports of Havre and New York.

The Minister of Finance is authorized to treat, within the space of three months, with a commercial company who will undertake the service, on condition that they receive in payment an annual fee not exceeding 880f. per horse power. The number of steam-packets to be employed in the service of this line shall be three at the least, or five at the most; each packet to be propelled by engines of 450 horse power.

A list of conditions, to be drawn out by the administration, will determine the times of departure, the number of passengers, and every detail relative to the service of this line.

2. Two principal lines of communication shall be established by the Government, in order to convey the mails between France and America, and served by steam-packets of 450 horse power, one starting from Bordeaux every 20 days, and from Marseilles every month, in order to arrive at Martinique, and continuing by Guadaloupe, St. Thomas's, Porto Rico, Cape Hayti, and St. Jago, to Havannah; the other starting from St. Nazaire every month to Rio Janeiro, passing by Lisbon, Goree, Pernambuco, and Bahia. Three secondary lines, served by steamers of 220 horse power, will be established in order to continue the principal lines, the first to Mexico, touching at Vera Crux, Tampico, Galveston, and New Orleans; the second to Central America, touching at Chagres, Carthagena, Santa Martha, and La Guayra; the third to Montevideo and Buenos Ayres.

To effect this a special credit has been opened to the Minister of the Navy, to the amount of 28,400,000f., to be devoted to the construction, arming, and fitting up of 14 steam-packets of 450 horse power, and 4 steam-packets of 220 horse power, and which is to be appropriated to the expenditures of 1840, 1841, 1842, and 1843.

From the total sum of 28,400,000f. a grant is made to the Minister of the Navy—

	Francs.
1. For the year 1840, of	5,000,000
2. For the year 1841, of	10,000,000
Total	15,000,000

3. The steam-boats belonging to the Government shall be constructed so as to enable them, in case of necessity, to carry guns, and when performing the duty of packets to carry merchandise.

In the latter case the Government may either intrust them to the command of officers of the Royal navy or to sea-captains, whichever, in the interest of the service, it considers preferable.

4. When the command is intrusted to officers of the Royal navy, an agent commissioned by the administration shall be placed on board, and specially

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* The length of this boat is 236 feet, its depth 23 feet 3 inches, its width outside the paddle boxes 58 feet 4 inches, draught corresponding to the load, 16 feet, tonnage 1,340 tons. The engines are so constructed as to diminish the consumption of steam and fuel. It is said that they consume 33 tons of coal a day. The total cost of the vessel when it was launched was 55,000*l.*; since that time improvements have been effected in it which have amounted to 15,000*l.* It carries 700 tons of goods, 135 passengers. The rest represents the weight of the engine, the boilers, and the water.

* England had, in 1831, 840 commercial steam-boats, representing altogether 64,700 horse power. Besides which, the English Admiralty possesses 66 vessels, whose powers amount to nearly 9,400 horses, while in France we reckon only 640 commercial steamers, and 38 belonging to Government.

intrusted with the details of the service, respecting the carriage of passengers, merchandize, bullion, and the mails.

5. The articles of the title 4 of book 2 of the Code of Commerce, determining the responsibility of sea captains towards the consignors and their assigns, will apply exclusively to the commissioned agent.

6. Ordinances, published in the form of administrative regulations, will determine all the details of the service of steamers undertaken by the Government.

7. The steam-packets which are under the direction of the state will be considered as part of the Royal navy, and the time served by seamen on these packets will be considered as in the service of the state.

8. Royal ordinances, inserted in the *Bulletin des Lois*, and the official portion of the *Annales Maritimes*, will fix the postage of the letters, journals, gazettes, and printed documents of every kind transmitted by the French Transatlantic packets.

Modifications introduced into the courses indicated in art. 2 will be published in the same manner, but such changes cannot take place with regard to the starting points in the kingdom or the general direction of the different lines.

9. The expences authorized by art. 2 will be provided for from the sums granted for 1840 and 1841 by the financial laws.

10. After the year 1842 the projected law for expenditures will include the demand of the funds necessary for carrying on the above lines of packets.

Steamers on the Pacific.—Extract of a letter from Captain Peacock, dated on board the Pacific Steam Navigation Company's steam-vessel Peru, lat. 9 15 N., long. 25 50 W., out 14 days from Plymouth :—"The Peru has hitherto had a most prosperous voyage, answering in every respect my most sanguine expectations. On leaving Plymouth we experienced a head wind, with a heavy cross swell, until the evening of the following day, when I ordered the fires to be burnt down, blew out the boilers, and made sail. On this first trial of sailing, although deep, we got seven knots out of her. There was a good deal of swell on, and the vessel occasionally rolled deep, but after a minute investigation of the moveable parts of the funnel, I saw no risk in lowering it, and in eight minutes from the commencement I had the gratification to see it snug in the chock, without straining a rivet or a rope-yarn. When the wind died away, we had every thing in its place again, and the fires alight in four minutes from hauling taut the main gears. The operation elicited the admiration of every one on board, and the correct workmanship of the arrangement reflects the highest credit on Messrs. Miller, Ravenhill, and Co. The funnel, when down in the chock, lies within the level of the paddle-box boats, and at a distance would resemble a long midship gun. It is completely out of the way of working the square mainsail, and when down, the operation of sweeping it is much simplified. We had only one entire day's sailing before getting into the trades, and then we had only three more. The trade wind was very light, except for two days out of the three, when, with the wind dead aft, with lower, topmast, and topgallant studding sails set, we went 11 knots for four consecutive hours, and in 24 hours ran 225 miles. This was the greatest run under sail. The least was 140, and this was the fifth day of sailing, when near the edge of the variables. We only consume half a ton of coals per hour on the average, and find no difficulty in keeping steam, without the additional length of funnel. The Hull coals are excellent; and in my own, as well as the chief engineer's opinion, are superior to the Llanelly coals. The sails all fit admirably, and the engines work extremely well. The vacuum now exceeds 28 in both. I perceive the great advantage of Sir W. Burnet's patent solution on the studding sails and awnings; it will increase their value 50 per cent. I am happy to inform you that my passengers are well, very contented, happy, and comfortable, which is daily expressed. I hope to be at Rio on the 26th day, of which there is every prospect."

Father Thames.—On Tuesday the 8th ult., an experimental trip was made with this new vessel intended to run from London to Gravesend. She is an iron boat, built by Messrs. Ditchburn and Mair, of Blackwall, and fitted with a pair of 37 horse oscillating engines by Messrs. Penn and Son, of Greenwich. She started from the Brunswick Wharf, Blackwall, with several Directors of the Blackwall Railway, and a party of scientific and naval gentlemen, at 21 minutes after 3, and arrived at the Pier, Gravesend, at 33 minutes past 4, making the trip in 1 hour and 12 minutes. She run the mile distance at Long Reach (with the tide) in 3 minutes 22 seconds, which is at the rate of 17·8 miles per hour. After staying at Gravesend for some time, she started off with the *Ruby*, the crack Gravesend boat; it was very soon perceived that Father Thames was making a head of the Ruby, and after running a short distance the Father went completely round her. The Father Thames then followed her, passed her again, and by the time she was off Blackwall, the Ruby was 2 miles astern. Messrs. Ditchburn and Mair have so constructed the bow of the vessel that she does not throw up the slightest wave in front, in fact we could scarcely perceive a ripple so clean did she cut through the water. This is an important improvement, and one that Mr. Ditchburn has been trying to obtain for many years, and who at length, we are happy to say, is successful.

ENGINEERING WORKS.

WOOLWICH DOCK-YARD.

The extensive improvements taking place in this great naval depôt are such as will, in a short time, render it superior to any in the kingdom. The dry dock opposite the blacksmith's shop at the east end of the yard, is without exception the finest and most commodious that has ever been built, and is constructed of the most durable materials, being first laid in the bottom with one foot of brickwork, and over it large granite stones, about 3 feet 6 inches in thickness, and each many tons in weight. The base of this dock is 230 feet in length, and of a proportionate breadth; but it will contain vessels of upwards of 300 feet in length on the upper deck, owing to the manner in which it is constructed. At the west end of the dockyard excavations have been going on during the whole summer, for the purpose of making a dock of still greater dimensions, designed by Mr. Walker, engineer, and it is intended to lay the foundation stone in the course of a few days. The contractors for this dock, Messrs. Grissell and Peto, of York-road, Lambeth, have had great difficulties to contend with in making the excavations. At a few feet from the surface they came on a rich alluvial deposit, in which the hazel and other nuts and clumps of trees were found in a perfect state of preservation, and the leaves were in many instances in layers six feet thick. Under these was a considerable bed of concrete like blue clay, all of which had to be gone through before a safe gravelly bottom could be found. This has now been obtained, but not without great interruption from powerful springs rising in all directions, and it has required the constant and unceasing exertion of a 40-horse power steam-engine pumping night and day to enable the men to proceed with their labours. The dimensions of this dock will be 300 feet at the base, and, as it will be constructed on the improved principle, it will admit of vessels of 400 feet in length on the upper deck. This is considerably larger than any ever yet made, but it is anticipated that steam-vessels of this gigantic size will be laid down when docks capable of containing them for fitting and repairing are ready for their reception.

Fiskerton Drainage.—The new steam water engine, for the better drainage of the fen-lands on the north side of the river Witham, between Fiskerton and Short Ferry, is at length upon the point of completion. A meeting of the proprietors was held at the City Arms hotel, Lincoln, on Friday, the 4th ult., for the purpose of hearing the opinion of Mr. Tuxford, engineer, of Boston, relative to the working of the engine, he being deputed to inspect the works, and to advance part of the contract money to Mr. Smith, of Belper, who furnished the building with the necessary works for the engine, and to decide upon paying him the remaining sum when the alterations pointed out by Mr. Tuxford were completed.—*Nottingham Journal.*

Woolwich.—The foundation stone of the new dock at Woolwich, was laid on Tuesday, 22nd ult., by Mr. Walker, the engineer, attended by the authorities of the dock-yard. The construction of this dock is different from any that has ever been made before. The stones are so cut that when placed together they will act on the same principle as an inverted arch. By this plan the greater the weight and pressure of the vessel in the dock, the greater the security that the bottom will not be raised by springs of water or from any other internal cause.—*Times.*

Liverpool Dock Committee.—At the meeting of this committee on Thursday, Sept. 17, Mr. Ald. Evans gave notice of his intention to move for a sub-committee to frame a Bill to Parliament for the construction of a new dock or docks, and warehouse on the docks and quays in this town.—*Liverpool Chronicle.*

PUBLIC BUILDINGS, AND IMPROVEMENTS.

The City of London and Tower Hamlets Cemetery, situated in the Mile End Road, comprising 22¼ acres of land, is now proceeding under the directions of Messrs. Wyatt and Brandon. The style of the buildings and enclosure will be Early English.

The Pedestal at Hyde Park Corner, placed in the centre of the crossing from St. Georges' Hospital to the entrance to Hyde-park, has been erected by the trustees of the Grosvenor-place District, and is about 100 feet westward of the district boundary. The pedestal which is circular, is executed in *Park Spring stone*, and is 2 ft. 8 in. diameter at the base, and 6 ft. 1 in. high. The column supporting three lamps is executed in cast iron, and is 7 ft. 9 in. high to the brackets, supporting the two side lights. The total height from the paving to the top of the centre light is 19 ft. 6 in. The whole pedestal is surrounded with Aberdeen granite kirb, enclosing a causeway 10 feet square, which is paved with Yorkshire stone, forming an octagon line round the base of the pedestal. An Aberdeen granite post 13½ inches diameter at the base, diminishing to the top, and 3 feet high is fixed at each angle of the causeway for the protection of foot passengers on their way from one side of the road to the other, being a distance of 87 feet. The top arrises of each of the plinths of the pedestal is chamfered off, and the cap (above a band upon which is inscribed "Grosvenor Place District, 1840"), molded for the purpose of preventing persons climbing up, and to obviate, if possible, the necessity of having the encumbrance of iron rails or spikes. The pedestal has been executed and fixed by Mr. Samuel Cundy, of Belgrave-wharf; the iron work by Messrs. Thompson, of Eccleston-street, East; the granite posts by Messrs. Thompson, of Millbank, Westminster, and the paving by the workmen belonging to the trustees, from designs and drawings, and under the superintendance of Mr. Turner, the surveyor to the trustees.

A Church in Bethnal Green, in the Early Lombardy style of architecture, is now being built under the directions of Messrs. Wyatt and Brandon.

Ramsgate Chapel.—This building is 110 feet in frontage, 60 feet in width, and 90 feet in height, to the top of the tower. The style of architecture is original, uniting the features of Saxon and Norman, with a slight indication of the Gothic, which are so designed and blended together that the whole building is kept in perfect symmetry of style throughout. The interior is fitted up in a kind of double theatre, having at each side rising seats, with a row of seats in the centre. The interior is plain, but would have been executed in a more elaborate style had not the limited funds prevented. There are galleries at each end of the chapel, one appropriated for the organ, and the other for children. The cost of the entire building is about £4,000, and is capable of containing 1400 persons. Mr. James Wilson, of London and Bath, is the architect.

A spacious building for the Southwark Literary and Scientific Institution, situated in the Borough Road, occupying a frontage of 50 feet by 70 feet deep, is now in course of erection; it will comprise a Library, Reading Room, Newspaper Room, Class Rooms, Lecturers' Room, and Librarian's apartments. Messrs. Wyatt and Brandon are the architects.

MISCELLANEA.

Improved methods of coating iron, under various circumstances, to prevent oxidation or corrosion, and for other purposes; patented by James Beaumont Neilson, Glasgow, Aug. 29.—The inventor claims the method of coating or covering iron, &c., by means of copper or alloys of copper, with zinc or tin. The copper or alloy is brought to that minute state of division in which it is obtained by precipitation from its solution, or it may be used in a granulated state. In order to cover cast-iron, sprinkle a thin coating of granulated, or other fine copper or alloy over the surface of the mould, to which may be added borax, or other flux, to facilitate the spreading or diffusion of the metal. Thus, when the molten iron is poured into the mould, the copper or alloy will be fused, so as to cover the casting, and render it secure against oxidation or corrosion. If malleable iron is to be coated, put a covering of the pulverised copper or alloy over the upper surface of the iron, while it is being heated, and the borax or other flux will soon cause it to spread over the heated part, which should be plunged into water, to detach the scale of oxide that forms upon it.—*Inventor's Advocate.*

Improvements in apparatus for withdrawing air or vapour; patented by Samuel Carson, Caroline-street, Euston-square, Aug. 5.—The inventor states, that revolving heads with cones have been applied to chimneys, in order to improve the draft thereof, but in such case the cones have not been made of sufficient length to pass beyond the opening of the chimney; hence the same has been of little use, owing to the wind being blown down the chimney. First improvement is for withdrawing heated air from chimneys, by means of the atmospheric air blowing through a cone, situated in a cylindrical box that revolves, at the chimney top, by the aid of a vane or weathercock; the wind passing through this cone, the orifice of which extends beyond the opening of the chimney or shaft, causes by its attraction or draft the smoke from the fireplace, or rarified air of the chamber, to rise with velocity, and pass round the casing connected to the chimney by a revolving joint. Second improvement consists in bringing the pipe that is to carry off the condensed or heated air of an apartment, down to the conical apparatus situated near a jet of steam, or near the waste steam-pipe of a boiler. In place of the atmospheric air passing through the cone, a jet of steam is made to draw off the confined air of the chamber, or from the bottom of a mine. Third improvement is to introduce a jet of steam into a chamber, without the use of a cone, whereby the vacuum is produced, and the confined air passes up from the mine or chamber through the valve at the upper orifice of the tube. This improvement we have examined at the Polytechnic establishment, where it works beyond all expectation, and we have since learned that Mr. Brunel has allowed Mr. Carson to introduce it at the Thames tunnel, where a four-horse engine cannot sufficiently ventilate the shaft; by this improvement, the waste steam alone will perform the whole operation.—*Ibid.*

Materials used in lighting or kindling fires; patented by Richard Edwards, of Fairfield-place, Bow, Middlesex, Aug. 29.—In the ordinary faggots of wood, used for lighting fires, there is not sufficient ventilation to allow the wood to burn, in case it be used in the close form of a bundle, but by this improvement, the pieces of wood are so combined with rope, cotton, paper, or other such like material, as to leave a space between each slip of wood or reed; thus it becomes what the inventor terms a "Ventilated Faggot," which may have its ends dipped into pitch, tar, resin, liquid sulphur, or other inflammable matter. By throwing one of these "ventilated faggots" into a fire-place, the coals may be heaped over it, and the servant, or other individual, will find no difficulty in causing the fire to burn after it is once lighted.—*Ibid.*

An improved method or methods of adjusting, shifting, and working theatrical scenery and apparatus; patented by Rowland Macdonald Stephenson, Upper Thames street, civil engineer, Aug. 29.—The object proposed by the patentee is the greater speed and facility with which stage scenery may be brought forward, shifted, or removed. The arrangement about to be described, provides means for shifting or removing simultaneously, and without noise, 35 distinct pieces of scenery, viz., 10 side scenes removed and 10 fresh subjects brought forward; five sets of clouds removed and five substituted; and five main scenes removed. The general arrangement of the machinery for effecting the above, may be described as follows:—The interior of the house between the basement and the roof may be said to be divided into four floors or compartments, viz., 1. a raised platform, on which the gearing for working the stage-traps is to be placed. 2nd. The stage with traps of various forms and dimensions, including a considerable portion formed to rise or fall by suitable machinery, and called the sinking stage. 3rd. The lower flats, between which and the stage are placed the wing scenes: between the framing formed by the girders and the supporting columns, and stretching from side to side of the stage, are suspended the border frames, which can be raised or lowered by means of ropes passing over drums and connected with counterpoise weights; and fourthly, the upper flats upon which the inventor places the moving power to communicate motion to the whole. On each side of the stage on the upper flat, are placed a series of frames called main scene carriages, having racks, which can be connected with pinions or long horizontal shafts when required to be moved backwards or forwards; these two shafts are connected at their extremities by a third shaft. From the upper horizontal shafts, by means of bevel gear and vertical rods, on the lower ends of which are drums, an endless chain is driven horizontally in either direction, to which are attached the borders representing clouds, foliage, arches, &c. The side frames, of which the number is limited by the depth of the stage, may be either flat, circular, or triangular; in the present case they are triangular, and receive a forward, backward, or rotatory motion, or both at pleasure, and can be placed at any convenient angle to the audience, so as to represent closed doors, &c.; at every change of the scene they will be moved round 130 degrees, or one-third of a circle; the whole of the side frames may be moved together or separately, by means of gear connected with the moving power on the upper flat. Attached to the centre of the border frames, and revolving on a pivot, are the traversing frames for crossing the stage in any direction, and at any given inclination; these, when ready for use, are raised up and secured at one end so as to form an inclined plane, and the object to be traversed having been attached to a wire passing round a drum fixed in a heavy frame, will descend by its own gravity. The trap-frame consists of a rectangular platform traversing on the lower or fixed platform, and having an upright frame of iron mounted on rollers and capable of being traversed on the lower platform in any direction; when brought under the aperture in the stage, it allows the trap to be sunk steadily by bearing on a disc or square iron plate, counterbalanced by weights. The claim is to the improved mode of shifting and working scenes and theatrical machinery, and to the obvious modifications of which the above arrangements are susceptible. —*Ibid.*

Improvements in the stuffing boxes of lift pumps; patented by James Horne, Clapham Common, Esq., March 3, 1840.—These improvements consist in the application of two cupped leathers to the purpose stated, in the following manner: the stuffing-box consists of a metal collar and cap, each having a projecting ring or shoulder on the inside; two pieces of leather are blocked into the form of cones with a horizontal base, having an aperture at the apex just large enough to receive the piston-rod; one of these cones is placed upon the piston-rod with its apex downwards, its base resting upon the shoulder in the collar of the stuffing-box; a metal disc is then slipped on to the piston-rod, and afterwards the second leather cone with its apex upwards, its base resting upon the metal disc; the stuffing-box cap is then put into its place, and screwed down tight. The metal disc becomes a guide for the piston-rod, while the pressure of the fluid below, and of the air above, upon the external surfaces of the two cupped leathers, keeps all tight. The arrangement is doubtless a good one, but we think the patentee would hardly have gone to the expence of a patent, had he been acquainted with the more beautiful, as well as more ingenious mode of constructing stuffing-boxes, employed by Bramah in his hydraulic press half a century ago; and which has proved efficient under greater pressures than a lift pump can possibly be exposed to. —*Mechanics' Magazine.*

Petroleum Oil Well.—About ten years since, whilst boring for salt water, near Burksville, Kentucky, after penetrating through solid rock upwards of 200 feet, a fountain of pure oil was struck, which was thrown up more than twelve feet above the surface of the earth. Although in quantity somewhat abated after the discharge of the first few minutes, during which it was supposed to emit seventy-five gallons a minute, it still continued to flow for several days successively. The well being on the margin and near the mouth of a small creek emptying into Cumberland river, the oil soon found its way thither, and for a long time covered its surface. Some gentlemen below applied a torch, when the surface of the river blazed, and the flames soon climbed the most elevated cliffs, and scorched the summit of the loftiest trees. It ignites freely, and produces a flame as brilliant as gas. Its qualities were then unknown, but a quantity was barrelled, most of which soon leaked out. It is so penetrating as to be difficult to confine in a wooden vessel, and has so much gas as frequently to burst bottles when filled and tightly corked. Upon exposure to the air it assumes a greenish hue. It is extremely volatile, has a strong, pungent, and indescribable smell, and tastes much like the heart of pitch pine. For a short time after the discovery, a small quantity of the oil would flow whilst pumping the salt water, which led to the impression that it could always be drawn by pumping. But all subsequent attempts to obtain it, except by a spontaneous flow, have entirely failed. There have been two such flows within the two last years. The last commenced on the 4th of July last, and continued about six weeks, during which time about twenty barrels of oil were obtained. The oil and the salt water, with which it is invariably combined during these flows, are forced up by the gas, above two hundred feet, into the pump, and thence through the spout into a covered trough, where the water soon becomes disengaged and settles at the bottom, whilst the oil is readily skimmed from the surface. A rumbling noise resembling distant thunder, uniformly attends the flowing of the oil, whilst the gas, which is then visible every day at the top of the pump, leads the passing stranger to inquire whether the well is on fire.—*Silliman's Journal.*

Napier's Patent Shot Machine.—The Board of Ordnance have determined upon employing Napier's machine for making balls by compression at the Royal Arsenal, Woolwich; it is to be worked by steam, as also the turners and borers of cannon. At present, the same system as was in vogue forty years ago, is used in the boring of large guns, horses being employed as the moving power. This alteration will relieve about ten artillerymen who have charge of the horses employed in this duty.

Hint for House Decorators.—The walls had a novelty of decoration not peculiar to Affghanistan, as I have seen it in India, though never so well done as in the rooms I speak of; the chunam or plaster being stamped when moist or plastic, and worked into a pattern, over which a varnish of powdered talc is spread, which more nearly resembles the richness and hue of new and unused frosted silver plate than anything I have seen elsewhere. This might be introduced in London as a very cheap and elegant drawing-room decoration.—*Dr. Kennedy's Campaign of the Army of the Indus.*

Locomotive.—Mr. E. Rudge, of Tewkesbury, tanner, has obtained a patent for a new method or methods of obtaining motive power for locomotive and other purposes, and of applying the same. These improvements are for the construction and application of a new form of atmospheric engine, which may consist of two, three, or more open topped cylinders, placed either vertically or horizontally, the piston rods of which are connected with two or three throw cranks. The air below each piston in the cylinder is condensed by a jet of steam, when the preponderating influence of the atmosphere on the external surface of the several pistons produces the available power. The cylinders are lubricated by means of a small funnel on the top of the piston rod, whence the oil flows into a hollow space within the rod, and thence into a groove turned in the piston. In order to gain a reserve of power, for any particular purpose, a large cylindrical receiver is filled by a condensing air-pump placed on either side, and connected with the main shaft of the engine; thus when the carriage is descending the hill, the air-pumps will compress the air into the large cylinders, which again will supply the air for working the pistons while ascending a hill.—*Gloucestershire Chronicle.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH AUGUST TO 26TH SEPTEMBER, 1840.

William Daubney Holmes, of Cannon-row, Westminster, Civil Engineer, for "*certain improvements in naval architecture and apparatus connected therewith, affording increased security from foundering and shipwreck.*"—Sealed September 3; six months for enrolment.

Thomas Horne, of Birmingham, Brass Founder, for "*improvements in the manufacture of hinges.*"—September 3; six months.

James Bingham, of Sheffield, Manufacturer, for "*certain improved compositions which are made to resemble ivory, bone, mother of pearl, and other substances applicable to the manufacture of handles of knives, forks, and razors, pianoforte keys, snuff boxes, and various other articles.*"—September 3; six months.

William Freeman, of Millbank-street, Stone Merchant, for "*improvements in paving or covering roads and other ways or surfaces.*" Communicated by a foreigner residing abroad."—September 7; six months.

Thomas Motley, of Bath Villa, Bristol, Civil Engineer, for "*improvements in apparatus and means of burning concrete fatty matter.*"—September 7; six months.

William Coltman, of Leicester, Framesmith, and Joseph Wall, of the same place, Framesmith, for "*their invention of improvements in machinery employed in framework knitting or stocking fabrics.*"—September 7; six months.

John Whitehouse, the younger, of Birchall-street, Birmingham, Brass Founder, for "*improvements in the construction of spring hinges and door springs.*"—September 7; six months.

Samuel Parker, of Piccadilly, Manufacturer, for "*improvements in apparatus for preserving and purifying oils, and in apparatus for burning oils, tallow, and gas.*"—September 10; six months.

Mark Freeman, of Sutton Common, Gentleman, for "*improvements in weighing machines.*"—September 10; six months.

Paul Hanning, of Clement's Lane, London, Solicitor, for "*improvements in the construction of governors or regulators applicable to steam engines, and to other engines used for obtaining motive power.*" Being a communication.—September 10; six months.

Charles Delbruck, of Oxford-street, Gentleman, for "*improvements in apparatus for applying combustible gas to the purposes of heat.*" Being a communication.—September 10; six months.

Edward John Dent, of the Strand, Chronometer Maker, for "*certain improvements in clocks and other time keepers.*"—September 10; six months.

Henry Houldsworth, of Manchester, Cotton Spinner, for "*an improvement in carriages used for the conveyance of passengers on railways, and an improved seat applicable to such carriages and other purposes.*"—September 10; six months.

Hugh Lee Pattinson, of Bensham-grove, Durham, Manufacturing Chemist, for "*improvements in the manufacture of white lead.*"—September 10; six months.

George Alexander Gilbert, of Southampton-buildings, Gentleman, for "*certain improvements in machinery, or apparatus for obtaining and applying motive power.*"—September 10; six months.

Robert Goodacre, of Allesthorpe, Leicester, for "*an apparatus for raising heavy loads in carts, or other receptacles containing the said loads, when it is required that the unloading should take place at any considerable elevation above the ground.*"—September 10; six months.

James Pilbrow, of Tottenham, Engineer, for "*certain improvements in steam engines.*"—September 10; six months.

William Bedford, of Hinckley, Leicestershire, Frame-work Knitter, for "*certain improvements in machinery employed in manufacturing hosiery goods, or what is commonly called frame-work knitting.*"—September 17; six months.

Henry Fourdrinier and Edward Newman Fourdrinier, of Hanley, Stafford, Paper Makers, for "*certain improvements in steam engines for actuating machinery, and in apparatus for propelling ships and other vessels on water.*"—September 17; six months.

Moses Poole, of Lincoln's Inn, Middlesex, Gentleman, for "*improvements in preparing materials to facilitate the teaching of writing.*" Being a communication.—September 17; six months.

Walter Richardson, of Regent-street, Gentleman, and George Mott Braithwaite, of Manor-street, Chelsea, Gentleman, for "*improvements in tinning metals.*" Being a communication.—September 17; six months.

Samuel Draper, of Nottingham, Lace Manufacturer, for "*improvements in the manufacture of ornamented twist lace, and looped fabrics.*"—September 21; six months.

William Mill, of Blackfriar's-road, Engineer, for "*certain improvements in propellers, and in steam engines, and in the method of ascertaining and measuring steam power, parts of which improvements are applicable to other useful poposes.*"—September 21; six months.

Charles Handford, of High Holborn, Tea Dealer, for "*an improved edible vegetable praparation called* 'Eupooi,' *and the mode of manufacturing the same.*"—September 21; six months.

Thomas Pain, Junior, of Upper Seymour-street, Euston-square, Student at Law, for "*a plan by means of which carriages may be propelled by atmospheric pressure only, without the assistance of any other power, being an improvement upon the Atmospheric Railway now in use.*"—September 22; six months.

John Maughan, of Connaught Terrace, Edgeware Road, Gentleman, for "*certain improvements in the construction of wheeled carriages.*"—September 24; six months.

George Goodman, of Henley, near Birmingham, Needle Manufacturer, for "*certain improvements in the manufacture of mourning and other dress pins.*"—September 24; six months.

Thomas Muir and John Gibson, of Glasgow, Silk Manufacturers, for "*improvements in cleaning silk and other fibrous substances.*"—September 24; six months.

William Hirst, of Leeds, Clothier, for "*improvements in the manufacture of woollen cloth and cloth made from wool and other materials.*"—September 24; six months.

Henry Pinkus, of Panton-square, Coventry-street, Esquire, for "*improvements in the method of applying motive power to the impelling of machinery applicable amongst other things to impelling carriages on railways on common roads or ways and through fields, and vessels afloat, and in the methods of constructing the roads or ways on which carriages may be impelled or propelled.*"—September 24; six months.

John Johnston, of Glasgow, Gentleman, for "*a new method (by means of machinery) of ascertaining the velocity of a space passed through by ships, vessels, carriages, and other means of locomotion, part of which is also applicable to the measurement of time.*"—September 24; six months.

Pierre Erard, of Great Marlborough-street, for "*improvements in pianofortes.*"—September 24; six months.

Thomas Robinson Williams, of Cheapside, Gentleman, for "*improvements in the manufacture of woollen fabrics or fabrics of which wools, furs or hairs are the principal components, as well as for the machinery used therein.*"—September 24; six months.

Alexander Dean and Evan Evans, of Birmingham, Millwrights, for "*certain improvements in mills for reducing grain and other substances to a pulverised state and in the apparatus for dressing or bolting pulverised substances.*"—September 24; six months.

TO CORRESPONDENTS.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No. 11, Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

J. D., *the substance of his communication on Suspension Bridges has appeared in print before.*

"*A Student,*" *his communication will be noticed next month.*

J. I., *his communication dated 18th ult., was not received until the 24th, when it was too late to comply with his request.*

"*A Constant Reader,*" *it is difficult for us to give the names and addresses of the inventors at all times, it would subject us, in many instances, to be charged with the advertisement duty.*

"*A Constant Subscriber,*" *shall be answered next month.*

G.'s *work was not received until near the end of the month, it shall be noticed in the next Journal.*

A Subscriber wishes for the address of the agent for supplying the Porcelain Letters, noticed in our Journal in May last.

Books received—Scott's Cotton Spinner; The Process of Blasting by Galvanism; On Excavation and Embankment on Railway; Thoughts on Steam Locomotion; and Experiments on the Compass on Iron-built Ships; they will be noticed in the next Journal. We have been compelled to postpone further notices of Mr. Mushet's valuable work, and also Mr. Bartholomew on Specifications.

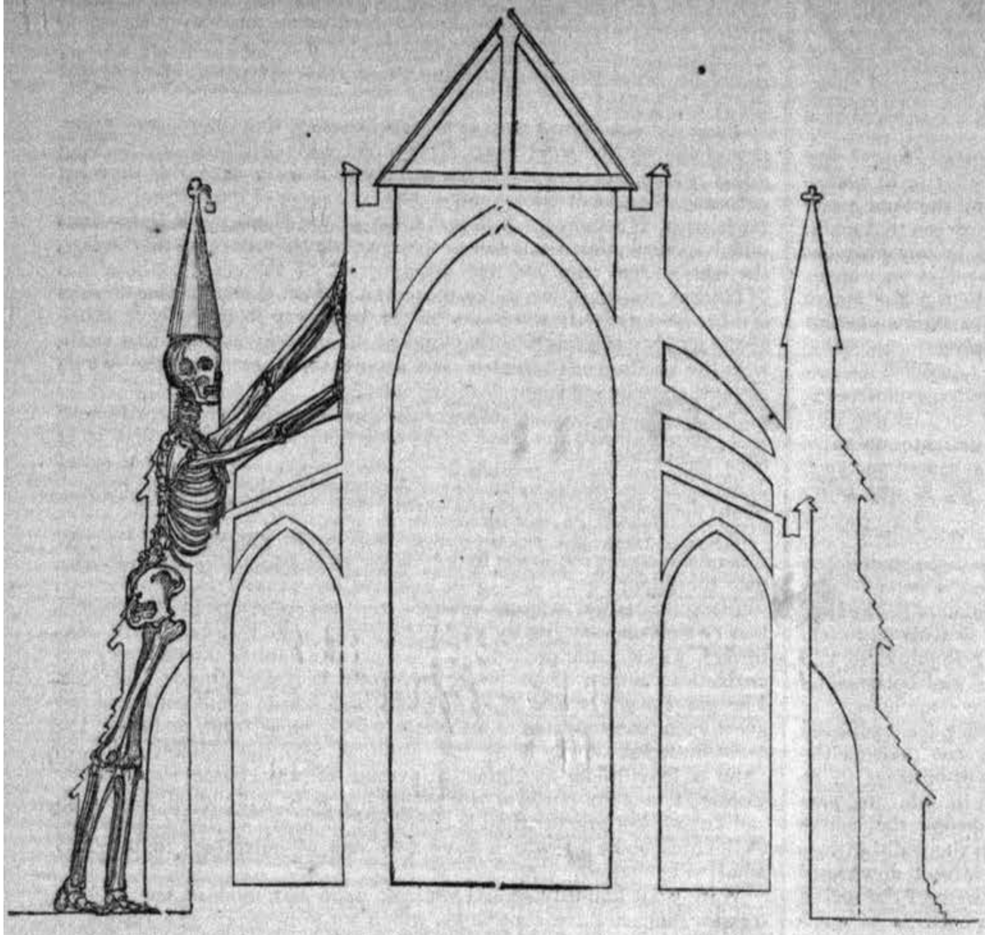
Next month we shall give the Plan of the Principal Floor and Section of the Reform Club.

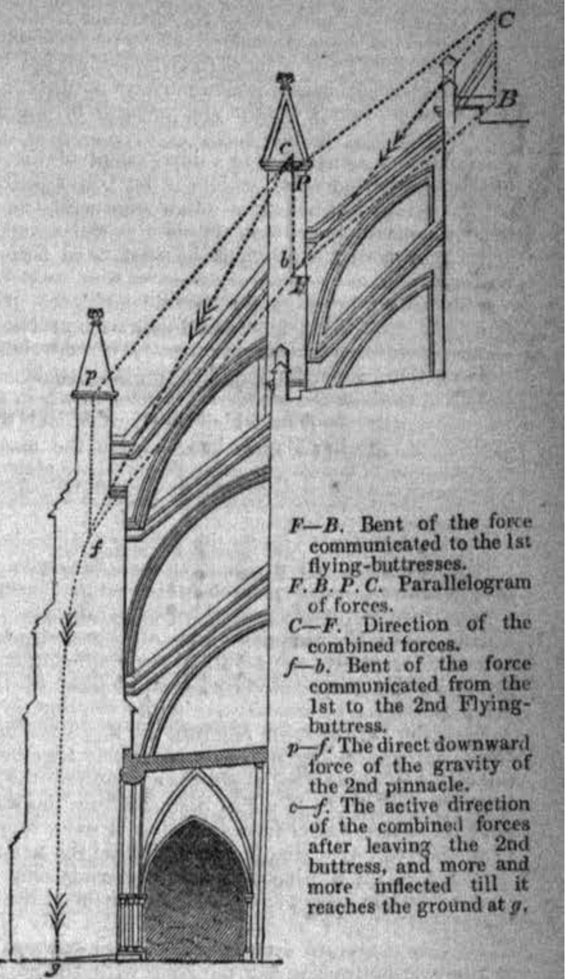
ERRATA.

In the August number, column 2, page 287, paragraph Steam Tug, *for* Buld *read* Bald; *for the velocity of wheel* 4·58 miles *read* 14·58 miles.

In the September number, page 321, column 2, for Tomson's *read* Thomson's.

ON BUTTRESSES, PINNACLES, &c.





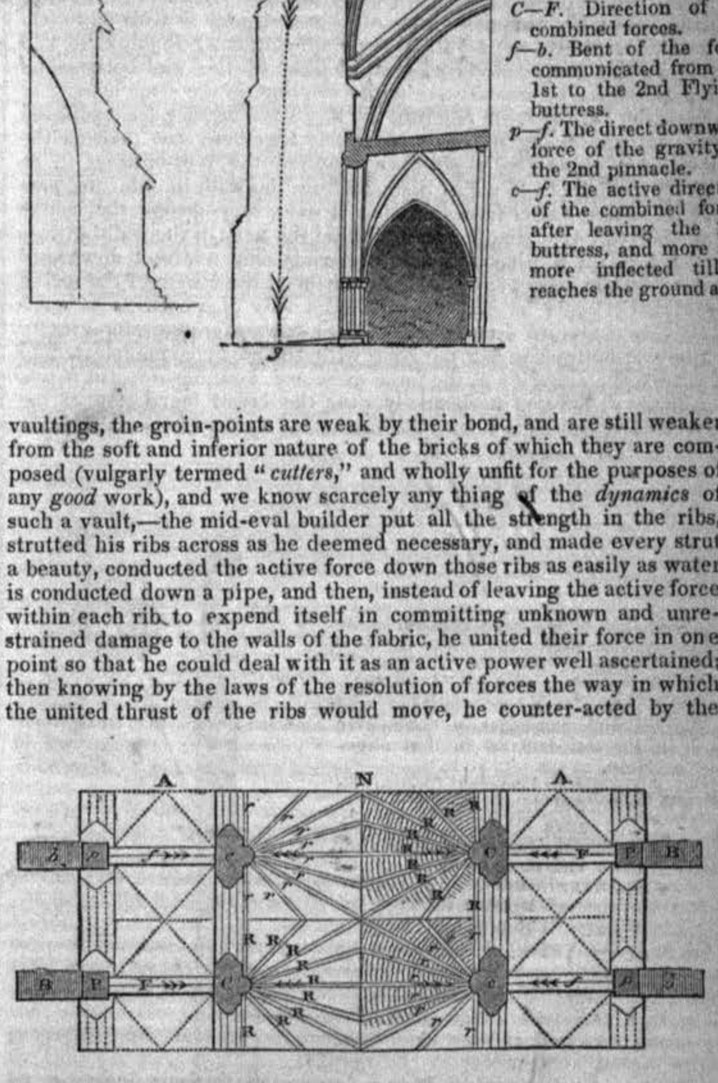
F—B. Bent of the force communicated to the 1st flying-buttresses.
F. B. P. C. Parallelogram of forces.
C—F. Direction of the combined forces.
f—b. Bent of the force communicated from the 1st to the 2nd Flying-buttress.
p—f. The direct downward force of the gravity of the 2nd pinnacle.
c—f. The active direction of the combined forces after leaving the 2nd buttress, and more and more inflected till it reaches the ground at *g*.

ON BUTTRESSES, PINNACLES, &c.

By Alfred Bartholomew, Architect.*

Were it the author's wish to prove by one example more striking than any other, the falling off of science in the absolute practice of architecture, in these times of pretended superiority, in which the ill-taught practitioner who wishes to pursue the integrity of his art, is obliged, after he is turned adrift by his master, to re-educate himself as far as he is able, by picking up whatever scraps of scientific information may fall in his way, instead of receiving from his master at once the full depth of skill which the free-masons for centuries handed down from father to son, from master to pupil, without diminution and without reserve,—he would fearlessly instance the most singular advancement which the mid-eval architects seem, by nothing short of inspiration, to have made in the most delicate acquaintance with *Architectural Dynamics*; a knowledge which taught them at once to unite in their abutments, strength with economy, use with beauty: while in our ignorance we fancy that strength and economy are enemies of each other and that use and beauty are of necessity opposite qualities. This refined intelligence taught them to render every necessary part of their constructions such exquisite ornaments, that the ignorant modern looking at them, without knowing their use, fancies them to be merely ornamental.

They first began in their vaultings with reducing the lateral thrust of the work to the smallest limits, by cutting out all the otherwise more level and hazardous parts of the vaulting, so that what remained scarcely left its perpendicular bearing upon the walls: they next greatly reduced further the weight of the vaulting, by forming it of small stone ribs, with a mere thin cuticle of lighter materials in short and narrow panels between the ribs; and whereas in our modern brick vaultings, the groin-points are weak by their bond, and are still weaker from the soft and inferior nature of the bricks of which they are composed (vulgarly termed "*cutters*," and wholly unfit for the purposes of any *good* work), and we know scarcely any thing of the *dynamics* of such a vault,—the mid-eval builder put all the strength in the ribs, strutted his ribs across as he deemed necessary, and made every strut a beauty, conducted the active force down those ribs as easily as water is conducted down a pipe, and then, instead of leaving the active force within each rib to expend itself in committing unknown and unrestrained damage to the walls of the fabric, he united their force in one point so that he could deal with it as an active power well ascertained; then knowing by the laws of the resolution of forces the way in which the united thrust of the ribs would move, he counter-acted by the



N, nave. A, A, aisles. R, R, &c., ribs of the vaulting, the several thrusts of which all uniting at the centre C; the dynamic action is confined to one point tending to move from C to F. F, flying-buttress, failing against the point C, in the direction exactly suited for opposing the united thrust of the vaulting-ribs. B, wall-buttress from which the flying-buttress springs. P, pinnacle. The small letters indicate the repetition of sets of the same parts belonging to other divisions of the vaulting.

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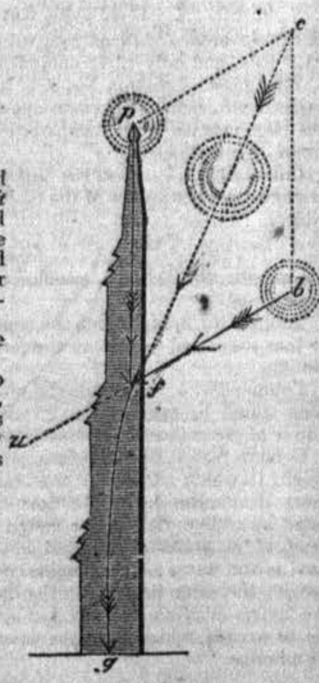
[*] We have through the kind permission of the author, taken this paper from a work recently published by him, entitled, "Specifications for Practical Architecture; preceded by an Essay on the decline of excellence in the Structure and in the Science of Modern English Buildings."

smallest possible quantity of materials set in the form of flying-buttresses, pinnacles, and wall-buttresses, that force which unrestrained might have endangered the walls. Thus by making use of only a small quantity of materials, every particle of which was brought into active service, he was enabled to carve ornament and enrich every part of his fabric out of those funds which we ignorant moderns expend in raising coarse masses which perform no duty, or ill-directed either waste much of their weight and strength, or else employ it in rending and dilapidating the fabric.

The author comes now to a department of the dynamic knowledge of the Gothic architects, which, as he believes it outstrips in combination of skill and beauty all other efforts of the architectural practitioner, ancient or modern, affords him matter of surprise, that as far as he knows or remembers, it has not been noticed by any previous writer.

The manner in which the Gothic architects conducted the active force of a vault to one place, and then with practical certainty counter-abutted that force by a small quantity of materials placed exactly in the situation proper for the purpose, has just been shown; it is now proposed to show the wonderful manner in which the flying-buttresses, the wall-buttresses from which they spring, and the surmounting pinnacles, are together disposed so as with the most delicate union of the extreme of beauty, to unite the most wonderful economy and such a knowledge of mechanics as will in vain be sought for in any other description of buildings.

Having found out exactly the precise place where the active force of the vaulting was pressing against the wall, they distended the *flying-buttresses* or *arc-boutant* widely at that part, in the same manner as a modern carpenter, in *temporary-shoring*, places a board flat against a dangerous wall; they then gradually concentrated this distention of the wall-thrust into one point, where the flying-buttress joins the wall buttress; thus they concentrated at the head of the wall-buttress, all the active force communicated by the vaulting, in the same manner as in wrestling all the force received by the arms becomes concentrated in the spine, pressing its vertebræ closely together; but then as the operation of this force, would have required the wall-buttress to be made sprawling out to a vast distance from the wall, in order to prevent the active power from throwing it over, they change the course of the active force, simply by running up the head of the wall-buttress in the form of a pinnacle, which, having only a direct downward gravity, by the *resolution of forces*, so changed the course of the active force, that it could be confined within the body of a buttress of comparatively moderate dimensions,—the downwardly-increasing gravity of the wall-buttress in fact mingling with the force communicated to it, curved the direction of the force more and more inwards, till it was eventually re-diffused horizontally over the broad foundation of the buttress, and was from thence communicated to the earth itself. Thus pinnacles, which are vulgarly considered merely as ornaments, became the most refined instruments in the economy and security of ecclesiastical and other buildings, and like the position of the human head, had a most material influence upon the stiffness and activity of the whole frame. With this knowledge, it was, that the Gothic architects proportioned the weight and size of their pinnacles, and when we see them assuming an extraordinary altitude, as at Worcester Cathedral, it is not from idle, wild, or luxuriant caprice, but because extraordinary means were required in order to change suddenly the course of an active power, which would otherwise have expended itself beyond the body of the abutment, and by displacing it, have brought to ruin the whole work.*



f—*b*. Bent of the force communicated to the flying-buttress by the *drift* of the vaulting, which force would proceed unrestrained to *u*, if the pinnacle were removed, and would consequently drive over the wall-buttress in that direction.

p—*f*. The direct downward force of the gravity of the pinnacle.

—*f*. The active direction of the two combined forces above-stated, more and more restrained in its downward course, within the body of the wall-buttress, till it reaches the ground at *g*.

f, *b*, *p*, *c*. Parallelogram of forces.

They did not always stop here, for knowing that there was a portion of the wall-buttress near the ground and adjoining to the side aisles, which received no thrust, and lay as it were dead, this they cut out altogether, as at Gloucester Cathedral, some of our English Chapter-houses, Westminster-hall, and some of the Continental Cathedrals which have chapels set between their wall-buttresses;† so that in fact, the whole form, position, and management of the counter-abutments of Gothic vaultings, were like those of a human skeleton, placed in a leaning posture, with the bones of the legs away from the base, those of the hands and arms pressing against the moving part of the vault, with the skull erect to confirm and steady the spine, and the whole strengthened by sufficient flesh and muscle.

That the true mechanical office of the pinnacles of pointed architecture is as stated above, appeared to the author to be so evident, that it at once struck him after coming to this knowledge, that the double set of flying buttresses on the south side of Westminster Abbey, must be respectively inclined, so as to receive within their solid substance the pressure of the vaulting; and that on account of the operation of the two sets of pinnacles, the lower flying-buttresses must be set more uprightly than the upper ones; this upon examination proved to be the case, showing that if the original builders were not fully versed in the subject (which may be greatly doubted), Wren, who restored these buttresses, was so, and probably by his great scientific knowledge, was enabled to adjust them more accurately to their proper positions. The great masters who had to do with this fabric, could not avoid the great extra consumption of materials which arose from removing the great buttresses away from the wall out into the cloister-green, in order to leave room for the north avenue of the cloister; but having a difficult task to perform, they performed it with admirable skill, and knowledge greater than is exhibited in many of the Continental Cathedrals, some of which have two sets of buttresses in order to admit side chapels.

With what humility should we look upon our modern use of buttresses, pinnacles and abutments, which we pretend are the results of a far outstripping science, and of an improved taste,—while men whom we have been in the habit of calling barbarians, have in a dark age (more enlightened in many things than the best ages of Greece and Rome) at once mingled in their works, poetry, economy, taste, strength, and invention.

Geometrical Survey.—The officers of the engineers appointed to conduct the survey of the island have been for the last six weeks stationed upon the top of Ben Volich, a high and peaked mountain in Rannoch, east of Lochgarry. They had spent the greater part of the summer on Schihallion, but the severity of the weather of late has both both impeded their operations and rendered the station very uncomfortable. For the last fortnight the snow has been lying some inches deep around their very superficial temporary dwelling, and the carriage of fuel from the surrounding districts is at once expensive and precarious. The view from this moutain, as well as from Schihallion, is very extensive from their commanding altitude, and enables the engineers to take a very wide observation.—*Scotch Paper*.

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* Rondelet in his "*Traité Théorique et Pratique de l'Art de Bâtir*," shows that he had sagacity enough to find out the beauty of the whole management of the dome of St. Paul's, and that he saw plainly the consolidating effect which the weight of the covering of the dome has upon the hollow cone; but it is singular that this sagacity did not preserve him from in some sort deprecating the oblique meeting of the cone with its supporting piers; he did not perceive, that besides the enormous collection of surrounding abutments which the great cone possesses, the perpendicular extension of the external peristylium above the foot of the cone, acts so as by the resolution of forces to materially change the direction of any expanding thrust which the base of the cone may possess, and to confine it strictly within the bodies of the first set of piers.

† Mr Savage, at the New Chelsea Church, has omitted the inactive parts of the wall-buttresses in order to admit a free passage in the dry areas which surround the basement-story of the edifice; but he has not changed the *drift* in the flying-buttresses by placing pinnacles over the wall-buttresses; allowing the present wall-buttresses of the church to be sufficient, the present combustible ceilings over the galleries of the church might be exchanged for groined roofs of stone, and the addition of pinnacles would still confine the drift within the present wall-buttresses, notwithstanding the added drift of the new side vaults.

ON CLOTHING OF STEAM BOILERS.

Report upon the advantages to be derived from Clothing Steam Boilers, Pipes, Cylinders, &c., with the Patent Felt, manufactured by Messrs. Borradaile, Whiting, and Company.

By THOS. WICKSTEED, Mem. Inst. Civil Eng., Hon. Mem. Roy. Cornish Polytech. Soc., &c. &c.

[WE feel much pleasure in being able through the kindness of Messrs. Borradaile and Co., to give to our readers the following very valuable report on Clothing of Steam Boilers and Cylinders, and which we are sure will be perused with much interest. We must here observe that too much praise cannot be given to those gentlemen for the spirited manner they have had the experiments made, which could not have been done excepting at a very large outlay. We think after a careful study of this report by those who have a steam engine not already clothed, they will hesitate no longer in adopting that very essential requisite, which we are sorry to say has been, heretofore, most shamefully neglected. The experiments were conducted under the direction of Mr. Wicksteed, the eminent engineer of the East London Water Works, whose abilities are too well known to the profession to need any praise on our part for the very elaborate manner he has performed his task.]

UPON the 25th of April last, Mr. Francis Whiting called and requested me to give an opinion as to the advantages of using Borradaile's Patent Felt as a non-conductor; and to state what I considered was the actual amount of saving in fuel obtained in the use thereof as a clothing for steam-boilers, cylinders, &c. I stated that, although I never had had the opportunity of trying experiments, I was satisfied it was a good non-conductor, and as the amount of saving stated as having been obtained by those that had used it varied from 6 to 17 per cent., I thought it would be advisable to try a series of experiments upon a large scale, continued for so long a time that the *experience* obtained should put at rest all question as to the actual amount of saving.

Mr. Whiting approved of this suggestion, and gave me instructions to try any experiments I thought proper.

In pursuance of these instructions I determined to ascertain the quantity of water evaporated by a given weight of coals, when the boiler, steam-pipes, and flues were exposed, or not clothed, and also when they were clothed with one, two, three, and four coats of the Patent Felt respectively; having been in the habit also of using hop sacking as a covering for the boilers, I determined to ascertain the evaporative power of the boiler when clothed with three and five coats of hop-sacking respectively, these experiments would give me the proportionate amount of fuel required to evaporate a given weight of water under the different circumstances before stated.

To ascertain the saving obtained by the use of the Patent Felt in clothing the cylinder, nozzle, and steam-pipes, I determined to ascertain the quantity of water that was required to pass through the cylinder in the form of steam, to do the duty of one horse, when the cylinder, steam-pipes, &c., were exposed, or not clothed, and when clothed partially, or wholly, with Patent Felt, as described in Table No. IV. appended to this report.

The boiler on which the experiments were tried was made by Boulton & Watt; it was of that form called wagon-headed, with a flue passing through the centre, the fire being underneath; the dimensions were as follow:

	Ft.	In.
Length of boiler	24	0
Depth	8	8
Width in widest part	5	11
Width of flue passing through the centre .	2	6
Depth of ditto ditto .	3	0

The engine, which was a single pumping-engine, was made by the same parties, the cylinder 60 inches in diameter, and average stroke 7ft. 11in.; the cylinder had a steam jacket around it.

A long series of experiments was made, the details of which are given in Tables Nos. 1, 2, 3, and 4, appended to this report.

Before commenting upon the experiments, I will give an explanation of the Tables, to show in what way the different results have been arrived at.

TABLE No. I.

The columns 1 and 2 require no explanation.

Column No. 3, shows the number of hours the engine was at work per diem of 24 hours.

Column No. 4, gives the bushels of coals consumed, which were accurately weighed, each bushel weighing 84 ℔., being the weight of the imperial bushel.

Column No. 5, gives the weight of water in hundred weights introduced into the boiler every 24 hours, the way in which this was ascertained was as follows:—There were two cisterns of given dimensions placed one above the other, the top one communicating with the feed pump of the engine, having an overflow, or waste water-pipe attached to it, and a valve in the bottom to let water into the lower cistern when required; the lower cistern communicated with the boiler, supplying it in the ordinary way adopted for low pressure boilers; the lower cistern was gauged, the gauge being divided into hundred weights, the divisions being obtained by actually weighing the water into the cistern; the lower cistern was filled with 21 cwts. of water, and when that was exhausted in feeding the boiler, the feed valve was closed, and the cistern was refilled with 21 cwts. more, so that the actual quantity evaporated was most accurately obtained.

Column No. 6, represents the mean temperature of the water in the lower cistern before evaporation, and was thus obtained: the temperature of the water each time the cistern was filled was taken, and again when it was nearly empty, the mean of all these temperatures is represented in column No. 6. The mean temperature in the line of Totals was obtained by multiplying each weight of water, given in column No. 5, by the corresponding temperature in column No. 6, the products being added together, and divided by the total weight of water, which gives the true mean temperature of the whole water evaporated.

TABLE No. II

Column No. 1, refers to the totals in Table No. 1.

Columns Nos. 2, 3, 4, 5, & 6, require no further explanation than has been already given.

Column No. 7, represents the pounds weight and decimals of a pound of water evaporated by the consumption of one pound of fuel; the water before evaporation being at the corresponding temperatures given in column No. 6.

Column No. 8, represents the cubic feet and decimals of a cubic foot of water evaporated by the consumption of 112 ℔. of coal, under similar circumstances to those given in column No. 7.

Column No. 9, represents the cubic feet and decimals of a cubic foot of water, that would have been evaporated, if the temperature of the water admitted into the boiler had been equal to 212° of Fah., and is obtained thus:* The latent heat of steam was stated by Mr. Watt to be equal to 950°, the sensible heat at the boiling point is 212°, the sensible and latent heat together being equal to 1162°, but as the water to be evaporated (see experiment No. 1,) had already 80·9° of heat in it, the number of degrees of heat required to be communicated to the water to convert it into steam would be 1081·1° only, and if the temperature of the water had been 212°, it would have required only 950° of heat (equal to the latent heat) to be communicated to it to convert it into steam, hence

Heat. Coal. Heat. Coal.
As 1081·1° : 112 ℔. :: 950° : 98·4 ℔.

Thus if the temperature of the water had been 212° Fah. before it had been admitted into the boiler, 98·4 ℔. of coals would have evaporated as much water as 112 ℔. of coals would have done, the temperature being 80·9, hence

Coal, Water. Coal. Water.
98·4 ℔. : 13.43 cubic feet :: 112 ℔. : 15·28 cubic feet,

in other words, 112 ℔. of coal will evaporate 15·28 cubic feet of water from 212° Fah., and only 13·43 cubic feet from 80·9° Fah.

The object of column No. 9, is to show a fair comparison between all the experiments, reducing them to one standard, which is rendered necessary from the circumstance of the temperatures given in column No. 6, varying in each series of experiments.

Column No. 10, shows the amount of saving in fuel under different states of clothing, or exposure of the boiler, steam-pipes, &c., as described in column No. 11.

TABLE No. III.

Columns Nos. 1, & 2, require no farther explanation than has already been given.

Column No. 3, represents the weight of water passing through the cylinder, or into the steam jacket in the form of steam, in the time stated in column No. 2.

Column No. 4, represents the number of strokes made by the engine in the time stated in column No. 2, which is necessary to be recorded, that the power of the engine may be ascertained.

Column No. 5, is the pressure under which the engine worked, or the height to which the water was raised, and was obtained by noting down every 15 minutes during the time the experiments lasted, the pressure, indicated by a mercurial syphon-gauge attached to the pump, then taking the mean of the pressures so noted down, and adding to it the height from the level of the water in the engine well to the datum line of the mercurial gauge; the mean pressure in the line of totals was obtained by multiplying the figures in columns No. 4 and 5 together, and dividing by the total number of strokes, which gives the true mean of the observations made every 15 minutes.

TABLE No. IV.

Column No. 1 refers to the totals in Table No. 3.

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* Vide Mr. Parke's paper on the evaporation of water from steam boilers. Transactions of the Institution of Civil Engineers, vol. 2, page 172.

Columns No. 2, 3, 4, 5, and 6, require no farther explanation than has been already given.

Column No. 7, shows the average number of strokes made by the engine per minute during the time of the experiments.

Column No. 8, shows the effective power of the engine, and is obtained by multiplying the weight of water lifted each stroke (which was equal to $1920\frac{52}{100}$) by the pressure shown in column No. 6, and by the strokes per minute shown in column No. 7, the product being the number of pounds weight raised I foot high per minute, which, divided by 33,000lb., will give the horses' power indicated in column No. 8.

Column No. 9, shows the quantity of water (in decimals of a cube foot) required per hour to pass through the cylinder and steam jacket in the form of steam to produce one horse's power, and is obtained by reducing column No. 4 to cubic feet, and dividing by the hours given in column No. 3, and again dividing the quotient by the horses' power represented in column No. 8.

Column No. 10, shows the proportional quantity of water in the form of steam required per horse's power under different states of clothing or exposure of the cylinder, &c., as described in column No. 12.

Column No. 11, shows the proportionate saving of water by clothing the cylinder as described in column No. 12.

Upon examination of the results shown in the Tables, a description of which has just been given, it will be seen in Table No. 2, that when the boiler was clothed with *one* coat of Borradaile's Patent Felt, that the evaporation was a little greater than when clothed with five coats of hop sacking. When clothed with *two* coats of felt it was not superior to *one* coat of felt, but when clothed with *three* coats, the evaporation was $1\frac{4}{10}$ per cent. greater; and when one coat of felt had been laid on the top of the flues, on the flag stones round the boiler, the evaporation was increased $3\frac{9}{10}$ per cent., and when the boiler was clothed with four coats, and the top of the flues with two coats, the evaporation was increased $\frac{5}{10}$ per cent. only; from this it would appear that to produce a considerable saving in fuel, it is necessary to have at least three coats of felt, and that the top flues should be coated with at least one coat of felt.

Upon examination of Table No. 4, it will be seen, that to obtain the greatest effect of saving from casing with Patent Felt, that not only the steam-jacket and steam-pipes should be clothed, but also the cylinder-cover, and steam-nozzle. The result of these experiments, which an examination of the tables will prove to have been carried on upon a large scale, each trial being continued for several days, shows that by properly clothing the boilers, steam-pipes, and flues, with Borradaile's Patent Felt, a saving of fuel of $10\frac{8}{10}$ per cent. may be effected; and by properly clothing the cylinder-steam-jacket, steam-pipes, nozzle and cylinder-cover, a saving of 15 per cent. is effected in the quantity of water converted into steam to produce a given effect: and consequently, the combined result is equal to a saving of fuel of $25\frac{8}{10}$ per cent.

Although the saving in fuel effected may be considered as the greatest advantage in using the Felt, yet there are others of no slight importance which should be noticed.

1st. The saving in the repairs of the boilers; supposing two boilers equally well made, of equally good materials, under which the same quality of coals is burnt, and in which the same quality of water is used, it is very certain that the wear and tear of the two boilers will be in proportion to the quantity of fuel burnt under them; now if the same effect can be produced by using 25 per cent. less fuel under one than under the other, the wear and tear will be 25 per cent. less in one than in the other; now although the actual amount of saving cannot be estimated, as it must depend upon the quality of materials and workmanship employed, which varies in almost every boiler, nevertheless, that it is a matter of importance will strike every one who has had to do with repairs of boilers.

2ndly. In steam-vessels it must be remembered that a reduction in the weight of coals is eqnivalent to an increase of tonnage, or in other words, supposing a foreign vessel whose cylinders, steam-pipes, and boilers are unclothed, carries in the course of twelve months 4000 tons of coals as fuel for the engines, a reduction in the fuel of 25 per cent. will enable them to carry 1000 tons extra weight of cargo.

3rd. Reduction in the cost of labour in working the engines, especially on board steam-boats. Upon this point it is not necessary to say more than that, by reducing the quantity of fuel to be used, and reducing the temperature of the engine room, and stoke hole, the labour of the engine men and stokers will be considerably less, and it is very evident a considerable saving may be made in this item of expenditure.

4th. If judiciously applied, the felt will prove a great safe-guard against fire, as it will be seen, by reference to Mr. Aikin's experiments, an account of which is appended to this report, that it may be exposed to a temperature of 400° Fahr. without being affected.

EXPENCE OF CLOTHING.

This, of course, must vary according to the size of the engine and boilers, whether land or marine, engines, &c. &c.; the cost, however, of clothing the engine upon which the trial was made, and *two* boilers with four coats of felt, the engine work covered with green baize oil-cloth, and the boiler with canvas, as herein before described, was £96; the engine working 12 hours per day exposed, or not clothed, would consume 1100 tons of small Newcastle coals per annum, which, at 17*s*. per ton would be equal to £935; 25 per cent. saving on this would be £233 15*s*. or 251 per cent. profit upon the outlay of £96.

DURABILITY OF THE FELT.

It has been the general practice to coat the boilers, pipes, and cylinders with a mixture of white lead, alum, Paris white, and linseed oil, before the first coat of felt is laid upon it, with the intention of preventing the felt from being scorched from direct contact with the heated metal; and it has been said that the fire which occurred in the Great Western steam ship when in the Thames, on her first voyage, was occasioned by the oil in this composition catching fire; to ascertain how far the use of this paint was necessary, and also what heat the felt would bear without being injuriously affected, I requested Mr. Arthur Aikin to try some experiments, and favour me with his opinion on this matter, and beg to refer you to his letter, which is appended to this report, and which to me appears most satisfactory; I also beg to draw your attention to his valuable suggestion of a new mixture to be applied in the place of that used at present in places where it may be found necessary, as being much more efficacious. With a view of showing the saving which may be effected by the use of the patent felt, I have calculated the Table No. V., shewing the saving in annual expence in proportion to the consumption of coals per annum, and the price per ton.

In conclusion, I beg leave to say that I had not, before I tried these experiments, an idea that the saving would be so great as it proves to be; the experiments have been, however, conducted with so much care, each series has been continued for so long a time, and the coals used having been from the same cargo, that I have not the slightest doubt any person clothing their boilers and engines in the *same manner, and to the same extent hereinbefore described*, will at once effect 25 per cent. saving in fuel, or in case of a boiler and steam pipes alone where an engine is not used, a saving of 10 per cent.

THOMAS WICKSTEED,
Civil Engineer.

Old Ford, August 14*th*, 1840.

REPORT OF ARTHUR AIKIN, ESQ., F.L.S., F.G.S., &c.

MY DEAR SIR—You inform me that it is customary to cover the outside of steam boilers with a paint composed of lead, oil and alum previous to applying the coating of felt. This you say is done with the intention of preventing the felt from being scorched by direct contact with the heated metal of the boiler. You require my opidion if it is necessary to interpose any substance in order to avoid injury to the felt, and likewiae inform me that in one instance a fire was said to have originated from the oil paint becoming overheated.

With the view of answering your inquiries in a satisfactory manner, my first object was to ascertain the utmost degree of heat which felt is capable of bearing without injury. For this purpose I put several pounds of mercury in an iron basin, and then placed another smaller basin on the mercury—in the smaller basin I put a layer of felt, and applied pressure to the upper surface of the felt sufficient to force the bottom of the iron basin in which it was contained, so deep in the mercury that there was only about half an inch of mercury between the two basins. A pot of burning charcoal was then placed below the larger basin, and a mercurial thermometer graduated to 600 Fah. was dipped from time to time in the mercury to ascertain the temperature. When the heat had risen to 300 Fah. a small piece of felt was immersed in the mercury between the two basins, and was withdrawn occasionally as the heat increased, in order to observe the effect produced on it. Up to the temperature of 440° or 450°, the felt appeared to suffer no injury, the colour remaining unaltered; but from 450° to 480° the colour first became deeper, the elasticity of the fibre was destroyed, it then became nearly black, and at the same time gave out the odour of burning hair. The hot charcoal was then removed, and on examining the felt which was in the small basin, it gave out, while warm, a burnt odour, and the surface in contact with the iron had become of a dark brown colour, as you may see in the specimen which accompanies this report. I consider therefore the heat of 440 Fah. as the highest to which felt can be exposed without injury, even for a short time (for my experiment did not continue above an hour), and if the heat were continued for several days, it probably ought not to exceed 400 Fah. If therefore the external heat of a steam boiler is liable to rise to 400 Fah., it would be prudent to interpose some substance between the surface of the boiler and the felt, but for this purpose oil paint with a basis of litharge, red lead or white lead is not to be recommended; for the oxides of lead are, all of them, especially the second, very easy of decomposition when mixed with oil and heated. While decomposing, that is, while the oxygen of the lead is combining with the combustible ingredients of the oil, a considerable increase of heat is excited, and this may, under favourable circumstances, be so great as to produce actual combustion of the oil.

In making experiments with the intention of discovering a composition free from the objections to oil paint, and at the same time cheap, the following occurred to me, and I find on trial that it adheres perfectly well when dry to the surface of iron, and will bear a heat of between 500° and 600° without material injury; it also retards considerably the efflux of heat, and will therefore, I think, be found a very good protection for the felt. It is made as follows:—

Take very stiff clay and sand (that of a bright yellow colour is best), dry them separately at a heat not much exceeding that of boiling water; reduce them to powder and pass them through a moderately fine sieve. Of the sand take four measures, and of the clay two measures, and mix them well; then add one measure of linseed meal, and one measure of horse dung, mixing them with the other ingredients as accurately as possible. Pour into any convenient vessel boiling hot water, and shake into it the above composition by small quantities at a time, observing that the last added quantity is thoroughly soaked before another is put in; there will thus be obtained a slippery semi-gelatinons mass which is best applied to the surface of the boiler by means of a trowel.

The first layer snould be very thin, and care must be taken that it does not slip down while wet, when it has become dry it will adhere firmly, and if its surface is left rather rough, the second layer may be applied without any hazard of its slipping.

A. AIKIN.

7, *Bloomsbury Square, Aug.* 6, 1840.

TABLE No. I.

Detail of Coals consumed and water evaporated in the course of 72 experiments, during which there were 4275 bushels of coals consumed, 1287 tons and 8 cwts. of water evaporated.

1	2	3	4	5	6	7
Reference to Table No. II.	Number of Experiments.	Duration of Experiments.	Quantity of Coals consumed.	Weight of Water Evaporated	Mean Temp. of Water before evaporation.	State of Boiler.
		Hours.	Bushls.	Cwts.	Degs. of Fahren.	
	1	10½	65	357	74·8	Boiler, steam pipes and flues exposed or not clothed.
	1	10½	63	357	76·6	
	1	10½	63	357	79·0	
	1	10½	64	357	83·6	
	1	10¼	62	354	85·2	
	1	10½	64	360	86·3	
I.	6	62¾	381	2142	80·9	
	1	10½	63	366	86·3	Boiler and steam pipes clothed with 3 coats of hop sacking.
	1	10½	63	376	86·7	
	1	10½	63	362	85·0	
	1	10½	62	357	85·1	
	1	10½	63	369	84·9	
	1	10½	63	364	84·7	
	1	10¾	64	375	85·6	
	1	10¾	62	360	85·1	
	1	10¾	61	356	86·3	
	1	10¾	63	375	87·0	
	1	10¾	63	376	88·0	
II.	11	116¾	690	4036	85·8	
	1	10¾	60	346	89·0	Boiler and steam pipes clothed with 5 coats of hop sacking.
	1	10¾	61	383	89·0	
	1	10¾	60	368	91·0	
	1	10¼	57	353	94·2	
	1	10¾	61	341	92·6	
	1	10¾	62	387	99·3	
	1	11	62	361	97·7	
	1	11	64	378	98·6	
	1	11¼	65	389	97·5	
	1	11¼	63	387	97·8	
	1	11¼	65	387	96·8	
	1	11¼	65	375	95·8	
	1	11¼	64	373	93·5	
III.	13	142¼	809	4828	94·9	
	1	11¼	64	382	95·0	Boiler and steam pipes clothed with 1 coat of Borradaile's patent felt.
	1	11¼	65	383	95·7	
	1	11¼	63	380	94·3	
	1	11¼	63	380	93·4	
IV.	4	45	255	1525	94·6	
	1	11¼	61	375	92·4	Boiler and steam pipes clothed with 2 coats of Borradaile's patent felt.
	1	11¼	62	368	92·2	
	1	11¼	62	368	91·2	
	1	10½	59	344	87·0	
	1	10¾	54	319	87·4	
	1	11¼	53	314	85·7	
V.	6	66¼	351	2088	89·5	
	1	11¼	54	318	83·5	Boiler and steam pipes clothed with 3 coats of Borradaile's patent felt.
	1	11¼	52	312	83·5	
	1	11¼	51	305	85·4	
	1	11¼	52	307	85·0	
	1	11¼	53	316	86·3	
	1	11¼	52	314	87·5	
	1	11¼	51	313	90·0	
	1	11¼	50	312	90·7	
VI.	8	90	415	2497	86·4	
	1	11¾	55	341	94·0	Boiler and steam pipes clothed with 3 coats and flues round boiler, with 1 coat of Borradaile's patent felt.
	1	11¾	56	355	92·6	
	1	11¾	55	347	90·4	
	1	11¾	54	339	90·4	
	1	11¼	54	337	95·3	
	1	11¾	54	345	94·8	
	1	12	53	339	93·3	
	1	12	54	338	92·0	
	1	12	54	336	93·2	
	1	11½	55	361	95·3	
	1	14½	72	439	96·5	
	1	11¾	57	361	95·2	
	1	11¾	59	370	95·0	
	1	11¾	58	371	93·4	
	1	11¾	60	380	94·2	
	1	11¾	63	393	94·4	
	1	11¾	63	376	95·0	
VII.	17	202½	976	6128	93·8	
	1	11¾	58	364	92·0	Boiler and steam pipes clothed with 4 coats and top of flues with 2 coats of Borradaile's patent felt.
	1	11¾	58	366	93·3	
	1	11¾	57	359	95·3	
	1	11¾	57	359	92·3	
	1	11¾	56	354	90·3	
	1	11¾	56	351	92·3	
	1	11¾	56	351	88·4	
VIII.	7	82¼	398	2504	92·0	

TABLE No. II.

A summary of experiments detailed in Table I., and also showing the lbs. of water evaporated per lb. of coals, and cubic feet evaporated per 112 lbs. of coals from 212° Fahrenheit.

1	2	3	4	5	6	7	8	9	10	11
Reference to Table No.	Number of Experiments.	Duration of Experiments.	Quantity of coals consumed.	Weight of water evaporated.	Mean temperature of water before evaporation.	Water evaporated by 1 lb. of coals.	Cubit feet of water evaporated by 112 lbs. of coals.	Cubic feet of water that would have been evaporated by 112 lbs. of coals, if the initial temperature had been 212°.	Proportionate saving by the increase of evaporation 15·28 cubic feet being = 100.	State of Boiler.
		Hours.	Bushels.	Cwts.	Fahrenheit	Lbs.	Cubic feet.			
I.	6	62¾	381	2142	80·9°	7·496	13·43	15·28	100	Boiler steam pipes and flues exposed, or not clothed.
II.	11	116¾	690	4036	85·8°	7·799	13·97	15·83	103·6	Boiler and steam pipes clothed with 3 coats of hop sacking.
III.	13	142¼	809	4828	94·9°	7·957	14·25	16·00	104·7	Boiler and steam pipes clothed with 5 coats of hop sacking.
IV.	4	45	255	1525	94·6°	7·973	14·28	16·04	105	Boiler and steam pipes clothed with 1 coat of Borradaile's patent felt.
V.	6	66¼	351	2088	89·5°	7·931	14·21	16·04	105	Boiler and steam pipes clothed with 2 coats of Borradaile's patent felt.
VI.	8	90	415	2497	86·4°	8·022	14·37	16·27	106·4	Boiler and steam pipes clothed with 3 coats of Borradaile's patent felt.
VII.	17	202½	976	6128	93·6°	8·371	15·00	16·86	110·3	Boiler and steam pipes clothed with 3 coats and flues round boiler with 1 coat of patent felt.
VIII.	7	82¼	398	2504	92·0°	8·388	15·03	16·93	110·8	Boiler and steam pipes clothed with 4 coats and top of flues with 2 coats of Borradaile's patent felt.

TABLE No. IV.

A summary of experiments detailed in Table No. III., and also showing the strokes per minute, power of engine, and water consumed per hour per horse power under different states of clothing.

1	2	3	4	5	6	7	8	9	10	11	
Reference to Table No. III.	Number of experiments.	Duration of experiments.	Weight of water evaporated.	Strokes made by engine.	Height of column of water under which the engine worked.	Number of strokes made by engine per minute.	Effective power of engine.	Water evaporated per hour to produce one horse power.	Proportional diminution in the water required per horse's power per hour ·828 of a cubic foot being = 115.	Saving effected by casing the cylinder &c.	State of Cylinder.
		Hours.	Cwts.		Feet.		horsepower	Cubic feet.			
I.	6	73	2282	48381	105·2	11·04	67·59	.828	115	100	Cylinder, steam jacket, and steam pipes exposed or not covered.
II.	7	82¼	2504	55555	105·8	11·25	69·26	·787	109·3	105·7	Cylinder, steam jacket, and steam pipes clothed with 4 coats of Borradaile's patent felt.
III.	5	58¾	1676	39602	106·0	11·23	69·27	737	102·3	112·8	Cylinder, steam jacket, and steam pipes clothed with 4 coats, and cylinder cover with one coat of Borradaile's patent felt.
IV.	4	47	1339	31818	106·7	11·28	70·04	·726	101·1	113·9	Cylinder, steam jacket, and steam pipes, cylinder cover and steam nozzle clothed with 4 coats of patent felt.
V.	5	58½	1668	39901	107·2	11·36	70·87	·720	100	115	Cylinder, steam jacket, and steam pipes, and cylinder cover and steam nozzle clothed with four coats of patent felt covered with green baize oil cloth.

TABLE No. V.

Showing the saving that may be effected per annum by Clothing the Boilers, Steam-pipes, Cylinders, &c., with Borradaile's Patent Felt, the consumption and cost of coals being as stated below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Consumption of coals per annum, if the boilers, &c. are not clothed.	Saving effected per annum by complete clothing with Borradaile's patent felt, the cost of coals being 2*s.* 6*d.* per ton.	Saving effected per annum, coals being 5*s.* per ton.	Saving effected per annum, coals being 7*s.* 6*d.* per ton.	Saving effected per annum, coals being 10*s.* per ton.	Saving effected per annum, coals being 12*s.* 6*d.* per ton.	Saving effected per annum, coals being 15*s.* per ton.	Saving effected per annum, coals being 17*s.* 6*d.* per ton.	Saving effected per annum, coals being 20*s.* per ton.	Saving effected per annum, coals being 24*s.* per ton.	Saving effected per annum, coals being 30*s.* per ton.	Saving effected per annum, coals being 40*s.* per ton.	Saving effected per annum, coals being 50*s.* per ton.	Additional tonnage obtained by the reduction in weight of coals for steam boats.
Tons.	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	Tons.
100	3 2 6	6 5 0	9 7 6	12 10 0	15 12 6	18 15 0	21 17 6	25 0 0	30 0 0	37 10 0	50 0 0	62 10 0	25
200	6 5 0	12 10 0	18 15 0	25 0 0	31 5 0	37 10 0	43 15 0	50 0 0	60 0 0	75 0 0	100 0 0	125 0 0	50
300	9 7 6	18 15 0	28 2 6	37 10 0	46 17 6	56 5 0	65 12 6	75 0 0	90 0 0	112 10 0	150 0 0	187 10 0	75
400	12 10 0	25 0 0	37 10 0	50 0 0	62 10 0	75 0 0	87 10 0	100 0 0	120 0 0	150 0 0	200 0 0	250 0 0	100
500	15 12 6	31 5 0	46 17 6	62 10 0	78 2 6	93 15 0	109 7 6	125 0 0	150 0 0	187 10 0	250 0 0	312 10 0	125
750	23 8 9	46 17 6	70 6 3	93 15 0	117 3 9	140 12 6	164 1 3	187 10 0	225 0 0	281 5 0	375 0 0	468 15 0	187½
1000	31 5 0	62 10 0	93 15 0	125 0 0	156 5 0	187 10 0	218 15 0	250 0 0	300 0 0	375 0 0	500 0 0	625 0 0	250
1500	46 17 6	93 15 0	140 12 6	187 10 0	234 7 6	281 5 0	328 2 6	375 0 0	450 0 0	562 10 0	750 0 0	937 10 0	375
2000	62 10 0	125 0 0	187 10 0	250 0 0	312 10 0	375 0 0	437 10 0	500 0 0	600 0 0	750 0 0	1000 0 0	1250 0 0	500
2500	78 2 6	156 5 0	234 7 6	312 10 0	390 12 6	468 15 0	546 17 6	625 0 0	750 0 0	937 10 0	1250 0 0	1562 10 0	625
3000	93 15 0	187 10 0	281 5 0	375 0 0	468 15 0	562 10 0	656 5 0	750 0 0	900 0 0	1125 0 0	1500 0 0	1875 0 0	750
3500	109 7 6	218 15 0	328 2 6	437 10 0	546 17 6	656 5 0	765 12 6	875 0 0	1050 0 0	1312 10 0	1750 0 0	2187 10 0	875
4000	125 0 0	250 0 0	375 0 0	500 0 0	625 0 0	750 0 0	875 0 0	1000 0 0	1200 0 0	1500 0 0	2000 0 0	2500 0 0	1000
4500	140 12 6	281 5 0	421 17 6	562 10 0	703 2 6	843 15 0	984 7 6	1125 0 0	1350 0 0	1687 10 0	2250 0 0	2812 10 0	1125
5000	156 5 0	312 10 0	468 15 0	625 0 0	781 5 0	937 10 0	1093 15 0	1250 0 0	1500 0 0	1875 0 0	2500 0 0	3125 0 0	1250

TABLE No. III.

Detail of water evaporated and strokes made by engine in the course of 23 experiments, during which the engine made 215,257 strokes.

1	2	3	4	5	6
Reference to Table No. IV.	Duration of each Experiment.	Weight of water evaporated.	Strokes made by Engine during Experiments.	Average pressure shown by gauge during each Experiment.	State of Cylinder.
	Hours.	Cwts.		Feet.	
	11½	361	7484	104·9	Cylinder, steam jacket, and steam-pipes exposed or not clothed.
	14½	439	9739	105·1	
	11¾	361	7820	105·3	
	11¾	370	7712	105·3	
	11¾	371	7950	105·1	
	11¾	380	7676	105·6	
I.	73	2282	48381	105·2	
	11¾	364	8218	105·5	Cylinder, steam jacket, and steam pipes clothed with 4 coats of Borradaile's patent felt.
	11¾	366	7748	105·5	
	11¾	359	7928	105·7	
	11¾	359	8012	104·5	
	11¾	354	7909	105·4	
	11¾	351	7790	108·3	
	11¾	351	7950	106·6	
II.	82¼	2504	55555	105·8	
	11¾	331	7885	106·8	Cylinder, steam jacket, and steam pipes clothed with 4 coats and cylinder cover with 1 coat of Borradaile's patent felt.
	11¾	326	8018	105·2	
	11¾	329	7819	106·3	
	11¾	342	7860	106·0	
	11¾	348	8020	106·1	
III.	58¾	1676	39602	106·0	
	11¾	336	7953	106·3	Cylinder, steam jacket, and steam pipes, cylinder cover & steam nozzle clothed with 4 coats of Borradaile's patent felt.
	11¾	336	7811	107·0	
	11¾	335	8015	106·7	
	11¾	332	8039	107·0	
IV.	47	1339	31818	106·7	
	11¾	344	7804	107·3	Cylinder, steam jacket, steam pipes, cylinder cover and steam nozzle clothed with four coats of Borradaile's patent felt, covered with green baize oil cloth.
	11¼	327	8044	107·1	
	11½	332	7852	107·1	
	11¾	334	8104	107·4	
	11¾	331	8097	107·4	
V.	58¼	1668	39901	107·2	

COMPETITION DESIGNS.

MR. SPARKE IN REPLY TO K. P. S.

SIR—In your number of this present month appeared a letter signed K. P. S., containing a charge against the persons who are engaged in building a New Church in this town. I have to request that you will give insertion in your forthcoming number to some observations in reply to those charges.

Your correspondent K. P. S. refers to a letter, dated Oct. 29, 1839, addressed by the Subscribers to the New Church to six Architects, inviting them to send designs for the proposed building, upon certain terms therein specified.

This letter is designated by K. P. S. as "most offensive." But surely it is impossible to conceive that the subscribers* *intended* an offence to the gentlemen with whom they sought communication. The letter indeed contained a clause, obliging the architect, whose design should be selected to carry the work into execution for the specified sum of £3,000, if required by the subscribers so to do. The subscribers, however, learnt that this arrangement was contrary to the practice of the profession, and therefore they at once altered the terms of the proposition to meet the wishes of the architects, who [so far as the subscribers are informed] were perfectly satisfied with the terms as amended, to which they all assented.

Let me now address myself to that point which has led the subscribers to think it proper to take notice of this letter of K. P. S., namely, the charge of bad faith towards the architects.

The substance of this complaint is, that the subscribers selected a design, the execution of which will cost £700 or £750 more than the sum mentioned in the instructions given to the architects.

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* K. P. S. criticizes the expression "Subscribers," and says "the business was of course conducted by a committee." He is as ill informed on this as on other points connected with this church. The subscribers at large, and not a committee transacted the business K. P. S. speaks of. The building committee was not appointed till after the design was selected.

Your correspondent K. P. S. says, "having selected the design, the subscribers proceeded to receive tenders for its execution; and it having been whispered that the estimates of the builders greatly exceeded the stipulated sum, the result was—not that the subscribers rejected the design and chose another—but that the tenders were returned to the builders unopened, and the designs referred back to the architect, for the purpose of being altered, so as to bring it within the means of the subscribers."

This statement is totally at variance with the truth. The first tenders were not returned to the builders, and the design was not referred back to the architect for the reason stated. This course was taken solely on account of an objection to the mode of constructing the roof, made by the Incorporated Society for building Churches; and the objection of the Society was communicated to the subscribers after the first tenders were received.

Your correspondent proceeds, "how the subscribers have fulfilled the conditions they dictated, may be seen by the following statement: 'The accepted tender amounted to £3550 in round numbers."

This Sir, is not in accordance with the fact: the sum for which the Church is to be completed is £3,353.

K. P. S. continues, "in addition to this, extra foundations, to the amount of £150 to £200, were found to be necessary, not in consequence of any unforeseen difficulty, such as might arise from the nature of the soil, &c."

The fact, Sir, is, that the "extra foundations were required by the nature of the soil." It was necessary to remove a very considerable body of earth for every part of the foundations, and in the site of the tower, the ground was excavated to the depth of 13 feet; and the foundations was made of the best concrete, comprised of lime and gravel, brought from a distance of nearly 3 miles.

"The cost of the building," continues K. P. S., "is therefore to be from £3,700 to £3,750."

This inference is very far from the truth. The sum for which the Church is be completed is, as I have before observed, £3,353. But from this gross sum is to be deducted the amounts of the drawback on the duties upon the customable and exciseable materials used in the building, as was expressly stated in the directions to the architects in the letter dated Nov. 30, 1839. This drawback is estimated at £350.

The cost of the Church, therefore, will amount as nearly as possible to £3,000, the sum which the subscribers have always stated that they intended to expend.

K. P. S. continues, "neither plastering nor painting are included in the contract."

This is opposed to the fact. The walls indeed are not to be plastered, but all the plastering which the subscribers think fit to do, *is included* in the contract; and so also is the painting.

K. P. S. continues, "instead of 650 sittings in pews on the ground floor, there are but 360; 180 more in open seats, and the remainder on benches."

The subscribers have thought fit to substitute for pews of three different widths, seats of uniform width throughout the body of the Church, some close pews, some open pews, and along the middle aisle, benches.

K. P. S. continues, "instead of stone quoins, there is not an atom of stone in the building but what may be indispensable."

This statement also is opposed to truth. There is much more stone in the building than would have been indispensable in making stone quoins: all the weatherings are of stone, as are also the string courses.

K. P. S. continues, "the window jambs, &c., are of moulded brick, not gauged brick, but bricks from the kiln, with good ⅜ joints between them. The side roofs are to be covered with zinc."

I have only to observe that there was nothing in the instructions to the architects which rendered it improper to build in the way that has been adopted.

K. P. S. continues, "the side walls are 2½ bricks thick, but, to save materials, are built hollow, the construction of the rest of the building being in strict keeping."

The inference which an incautious reader might be induced to adopt from this statement, would perhaps be this—that the walls are hollow throughout. Nothing could be further from the fact. There are no chambers, but in those parts of the walls where there is little weight to be supported. In the latter part of the last clause, K. P. S. has been more guarded and prudent than in the rest of his letter, because it is only an insinuation, and therefore does not admit of any direct contradiction.

K. P. S. continues, "whether all this is quite acting up either to the letter or the spirit of the instructions of the Incorporated Society, may admit of a doubt at least."

The doubt, Sir, is soon resolved; for the subscribers have the approbation of the Incorporated Society testified by the signature of their secretary upon the plans; and indeed the quantity of materials used in the walls is greater than is required by those approved plans.

"It will admit of a doubt," continues K. P. S., "whether a building with bare walls of ordinary brick, and fittings of naked deal inside, can be exactly said to maintain an ecclesiastical character."

How far the New Church can be said to maintain an ecclesiastical character, must be a matter of taste of opinion; but it is believed that no one has seen the designs of Mr. Ranger, the architect, without admiration of their beauty and their perfect adaptation to the purposes for which the building is required; and that no one has seen the building itself, so far as it has already been executed, without approbation of the mode in which the work is done.

So great a discordance between the statements of K. P. S. and the facts of the case, the subscribers conceive can only have arisen from this cause—that K. P. S. has seen neither the contract nor the building, and therefore neither knows what has been done, nor what it is intended to do. He might have seen both by applying either to me, or to the clerk of the works, and he is quite welcome to do so whenever he pleases.

I am, Sir, your obedient servant,
J. SPARKE, *Hon. Sec.*

Bury St. Edmund's, Oct. 19, 1840.

RANGELEY'S SAFETY ROTATION RAILWAY.

(With an Engraving, Plate XVII.*)*

IN the September number of our Journal we gave a short description of this invention, and also in the present number will be found an abstract of a paper read at the British Association, but as we thought many of our readers might feel interested in the proposed novel mode of transit, we have prepared the accompanying plate illustrative of the subject, and which, with the following description, will fully enable our readers to judge of its practicability.

This system consists in the adoption of two parallel lines of fixed wheels along the proposed road, at any moderate gauge, and at a short distance longitudinally from centre to centre of each wheel. These are termed the bearing wheels, which, together with a double pulley, are cast or keyed on to a common axle marked *d* and *e* in the engraving. The axles of these bearing wheels and pullies work in plummer blocks *c*, fixed on to cast-iron beds or bearing frames *b*, which are proposed to be in 12 feet lengths, and secured to three wood sleepers and to each other in the way shown in fig. 3; but to prevent elevating these iron beds much above the surface of the ground, a chamber of masonry or iron is necessary to enable the bearing wheels to revolve free from obstruction. Over every pulley is passed an endless band working into the adjoining pulley each way, so that for any distance that the road may be carried there would be an equal distance of band, but in a series of lengths, equal to the distance from each other, of pulley from pulley. Having proceeded so far in our description, we will now explain the method of action:—A steam engine, water wheel, or other motive power being connected with the pullies at each end of such a series of wheels, and motion given thereto, it would in a short time communicate it throughout; and each wheel revolving in the same direction, it is evident that any body placed on the upper periphery of the wheels, so that it could not quit the track, would be in a short time carried from one end to the other, and in greater or less time according to the greater or less rapidity with which the wheels revolve.

By referring to figs. 1 and 2, it will be perceived that the carriage is without wheels, and in fact a kind of sledge; an iron rail is fixed in the underside of the bearing frame to prevent the rapid wear which would otherwise take place from the friction of the wheels in progressing the carriage.

The safety of this mode of transit arises from a considerable portion of the carriage depending between the wheels, and which is termed the baggage box *k*, and the steady motion of the carriage will in a great measure depend on the load which may be stowed therein. To prevent lateral friction against the wheels on beds, guide wheels are fixed at each end of the baggage box, which will prevent the carriage at any time from quitting the track, and also assist in its passage round corners; a break at each end (for regulating the speed, or stopping the carriage, by slightly raising it, and of course diminishing the friction or bite of the wheels on the carriage), is shown in figs. 1 and 2.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XX.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. It is somewhat odd that those who profess so greatly to admire St. Paul's, Covent Garden, should not have cared to aim at the same kind of effect, as regards one peculiarity in it. It is almost doubtful, however, whether the circumstance alluded to has been taken into account at all, since it has never been especially pointed out, as deserving to be noted and studied. What I mean is, the projection of the pediment as seen in profile, and the bold shadows—or rather depth of shadow in the tympanum of the pediment. Perhaps I shall be told that this is a circumstance attending the peculiar kind of entablature and cornice there employed, and that consequently the same effect cannot be obtained in the pediment of a portico whose columns are of the Grecian Doric, or Ionic order. Most undoubtedly not, if we are determined merely to copy Grecian authorities, yet not only so slavishly, but so blindly, as not to study such modifications of the originals as shall in some degree give us a tolerable equivalent for what is unscrupulously abandoned in the professed copy, however essential it may be to resemblance. There is no occasion whatever for impoverishing Grecian architecture, yet we do so continually without the slightest compunction, making naked entablatures and pediments, with scanty cornices, absolutely *starving* our buildings, yet congratulating ourselves all the while on the classicality and purity of our taste, and fancying that we are perfectly Grecian, whereas we are no better than architectural paupers, dressed up in old finery of which the trimmings and embroidery have been cut away.

II. Should future generations form their ideas of Grecian architecture from our modern English imitations, prodigious will be their wonder at the praises bestowed upon it; for they will be greatly puzzled to discover in them any of its spirit, or any adherence to its principles—aught of refined taste and artistical feeling. In his recent work on *Kunst-Sinnbilder*, Menzel makes some remarks on the ancient orders and the modern versions of them, that architects would do well to take into consideration. He condemns the recipes and prescriptions for making Doric, Ionic, &c., given by Vignola, Palladio, Serlio, Scamozzi and others, as leading only to the most servile and blind imitation of the patterns so set, and which are certainly not the very best in themselves. Of even the very best examples, too, the continual repetition not only becomes wearisome in itself, but also tends to check all invention in design,—at least as regards detail, and so far degrades the architect from an artist to a mere parrot or automaton. Yet in this as in other matters over-strictness is apt to lead to the opposite extreme of licentiousness: and those who would be shocked at the idea of any innovation in Greek detail, even though it were perfectly in accordance with Greek feeling, feel no scruple whatever in reverting for the sake of variety, to such deformities as the Italian Ionic,—which would be reckoned positively detestable after Greek, were it not, that there is precedent for it, and it is not an invention of our own. Out upon the *servum pecus* of pedants, whose dislike to originality arises from their own incapacity to originate any thing whatever, and who therefore bolster up their own imbecillity by a most convenient veneration for precedent.—In the grounds of Mr. Anderson's villa in the Regent's Park, there has lately been executed a small building, the capitals of whose columns would scandalize such *pseudo-legitimates*, for the very reason that they must charm every one whose taste is any thing better than mere prejudice. Ionic in character, though unlike any existing example, they display genuine artistical feeling, and a perfect knowledge of architectural principles with a thorough contempt for ready-made architectural patterns, and for those who make use of them. By all means, let the Institute procure a cast of that capital; and were the two Professors of Architecture to do so likewise, they might get from it something they now seem to be terribly in lack of.

III. In an article on Modern Churches, British Critic, No. LII, there are many remarks worth attending to, and among others what is there said in regard to the excessive quantity of light admitted into churches generally, in consequence of painted glass having been destroyed or removed from the windows of the older buildings, and its not being introduced into those of modern ones, notwithstanding that the apertures are made as large, and the spaces between them as narrow, as if it were intended to damp the light, and hinder the effect of rawness generally, by glazing the windows with rich material. "Nearly all our ancient churches," says the writer, "from the cathedral to the smallest oratory are now considerably *overlighted*. They are not now seen in their proper dress; but are like the face of nature in winter without leaves or flowers. Thus the interior of Salisbury Cathedral is as light as the open air; nay, in a sense, it is lighter; for out of doors, there is an infinite variety of light and shade, and still greater variety of hue; but in that building, as reformers and puritans have left it, there is no relief, no repose: with inconsiderable exception, all is one equally monotonous, shadowless, colourless medium: nothing recedes, nothing stands out. The proportions suffer; for neither height nor length are felt in the glaring mass of day-light.—The cathedral is reduced to one great airy room. The aisles are no longer depths of shade; the lofty pillars and arches no longer stand out in bold relief, bathed in copious streams of light and colour from the high clerestory windows, every stone from the vaults above to the pavement under our feet seeming instinct with life."—"Our churches having been nearly all built or altered with a view to painted glass, as soon as this essential part of their plan was destroyed, there was immediately found to be double or treble the quantity of aperture sufficient for light. In spite of bad glass, windows wholly or partially blocked up, curtains, galleries, and staircases, lofty screens, and all the other numberless accretions of the last three centuries, they are still greatly too light. The restorations of the present age, by opening windows, substituting larger panes of clear white glass, clearing away heavy screens and partitions, and lowering pew-walls, have in fact accidentally increased the evil, and rendered the glare of our churches, especially those of the later styles, quite intolerable, not only to the mental feeling, but to the bodily eye."

IV. In speaking of Vestries, the writer just quoted is of opinion there is little occasion for them in country churches. Such a place "is useful of course to the *crack* preachers of the metropolis, some of whom sit there and *comfort* themselves during the service, that they may come forth fresh as giants to the event of the day—the sermon." It is said also that Dr. Parr used to illustrate his attachment to rural psalmody, by "*smoking in the vestry* during the performance of the choir"! Considering the character of the publication in which the article appears, these remarks are somewhat freely satirical, though certainly not without foundation; for I myself have been in an exceedingly snug vestry, where there was a delightful blazing fire, and every thing vastly *comfortable* indeed, so much so that I should have mistaken it for the parson's own parlour, had not the sash windows been much higher up from the floor than they are in modern houses; which certainly did not diminish the appearance of comfort, inasmuch as it afforded comfortable assurance that there was no danger of any one's accidentally peeping in.

V. Whether I be censured or not for my last comment, the passage which I shall now quote from the same writer, is so excellent, that I shall be thanked for here introducing it.—"Mere novelty is not *originality*. Many things have never been done; some things have never been thought of, simply because they are unnatural and out of the way. *True originality* is a power of invention or discovery; but whether employed in the regions of science or of poetry," (or of art) "it only discovers or invents what is, in some sense, natural and true. It does not so much *make* new ideas, as *find* what have escaped the minds of others. It conceives ideas which strike us at once as having a sort of self-evident propriety and beauty. Its creations are at the same time like and unlike what we know already,—like, in that they accord with our existent taste and notions;—unlike, in that they seem each to have an individual essence."—This last expression, indeed, is not altogether a happy one: perhaps it would be better to say—unlike, in that some new modification is presented to us, for which there is no actual precedent, but which recommends itself so strongly, and withal appears so obvious that we wonder no one should have hit upon it before.

VI. Shall I venture to quote another observation from the same source? Yes; for what the writer says in regard to the notion of Grecian architecture requiring greater attention to study and rules than Gothic does, is well worthy of attention. "There cannot be a greater mistake. Gothic architecture *appears* less formal and less regular than its ancient rival, only because it embraces *more* elements of calculation,—because it has *more forms and rules of art*." True, most true! A person may go through the whole of Grecian architecture—may learn all the Five Orders, *secundum artem*, in less time than he can make himself acquainted with the varieties of Gothic doors or windows, or any other single feature belonging to that style. Carpenter's Gothic indeed,—or even the Jemmy-Wyatt Gothic is a different matter;—that is *regular* enough, all done *by rule* without any study, and therefore regularly bad, or at least insipid.

ON LONG AND SHORT STROKE STEAM ENGINES.

By JOHN SEAWARD, C.E.

A popular notion has for a considerable time past prevailed, that a long stroke engine is much superior to a short stroke engine; and it will consequently be found that the practice of most, if not all engineers, is greatly regulated by this idea. On very careful consideration, however, it does not appear that this alleged superiority can be satisfactorily proved. That a long stroke engine, under certain circumstances, may be much more advantageously employed than a short one, is undoubtedly true, but considering the steam engine *per se*, that is without reference to adventitious or extraneous circumstances, it would be difficult to show that the former has any advantage whatever over the latter.

For let a careful comparison be made of a long stroke engine with a short stroke engine; let there be two beam engines of thirty horses power each, both equally well made, but the one having a stroke of eight feet, while the stroke of the other is only four feet, the cylinder of the latter being double the area of that of the former; it being understood that both engines shall make the *same* number of revolutions per minute; the steam passages and valves to be of the same area and capacity; and the two engines in all other respects to be well proportioned and made without any limitation as to space or weight.

Now as regards the mere mechanical effect of the moving power (*i. e.* of the steam) it is perfectly clear that it must be precisely the same in both engines, because the same volume of steam must produce the same mechanical effect whether it is let into a long narrow cylinder or into a short wide one; therefore, if there be found any difference in the efficient duty or economical working of these two engines, that difference must arise from circumstances quite unconnected with the mechanical effect of the steam power.

The only circumstances which really can make any essential difference in the efficient duty or economical working of these two engines are these:—First, the greater or smaller quantity of friction in the various parts of the machines. Second, the greater or lesser radiation of heat from the cylinders and passages; third, the greater or smaller loss of steam by the clearance of the piston at the top and bottom of the cylinder. Fourth, the *inertia* and the impulse of the parts of the machine in motion on the surrounding air.

First, then of the *friction*. It will be found in the working of a well made engine of the proportions of the short stroke engine under comparison, that more than four-fifths of the whole friction are due to the packings of the piston and air pump bucket, and of the piston rod and bucket rod,* and less than one-fifth to the main gudgeons, the end gudgeons, the crank pin and other moving joints about the engine. But the friction of the piston packing will vary as the circumference of the piston, multiplied into the distance which the piston travels. Now in the long stroke engine the piston supposing it to be 30 inches diameter, will move eight feet, and the friction of the packing be therefore as 24, while in the short stroke engine the piston will be about 42·4 inches diameter, will move only four feet, while the friction of the packing will be only as 17. In the same way it can be shown that the friction caused by the packing of the air pump bucket, of the piston rod, and of the bucket rod, is also respectively in the ratio of 24 to 17, in the two engines. With respect again to the friction due to the main and end gudgeons, &c., it is clear that it will be less in the long stroke engine, because in the latter engine, the force acting upon these parts will be one-half what it is in the short stroke engine. Assuming therefore 100 to be the whole quantity of friction in an ordinary engine then, 80 of these parts in the short stroke engine, will be due to the piston, air pump, bucket, &c., while in the long stroke engines the friction of these parts will be as 113 that is $= \frac{24}{17} \times 80$, but the friction on the main and end gudgeons in the former engines will be as 20, and in the latter only 10, making the total friction in the short stroke engine 100, and in the long stroke engines 123, or one-fourth more.

Second.—The *radiation of heat* will be in proportion to the extent of surface, but the surface of the long stroke cylinder, is much greater than that of the short cylinder, whence it follows that the loss by radiation in the former, must be greater than in the latter.

Third.—The *clearance of the piston* at the top and bottom of the cylinder, which will evidently be greater in the short stroke engine than in the long stroke engine. Because the area of piston in the former is double that of the latter, some persons would be disposed to say, that the loss by clearance in the former must be double what it is in the latter; but this is not quite certain, for it is not required to give so much clearance in a 4 feet stroke cylinder as it would be advisable to give in an 8 feet stroke cylinder, the reason of which is obviously that the spring and elasticity of the parts in the long stroke engine, must be much greater than in the short stroke engine, and that they must therefore require more clearance. However, it is probable that there would be more loss in the latter engine than in the former.

The loss of steam by filling the passages and nozzles, as also by the radiation of heat from those parts, must evidently be the same in both engines.

Fourth.—*The inertia and impulse of the moving parts on the surrounding air.* The loss in a steam engine occasioned by these two causes may not be very considerable; indeed as regards what is called the *inertia* of matter in the moving parts, it is doubtful whether any such source of loss really exists; however if it does exist, it is clear that the amount of loss must vary in proportion to the *momenta* of those parts of the machine which are in motion, but as the *momenta* must be as the mass of matter in motion multiplied by the velocity, and as these are evidently much greater in the long stroke than in the short stroke engines, (because the parts in the former, are if any thing, of greater weight than in the latter, and also move at a double velocity,) it follows that whatever loss may arise from the *inertia*, must be much greater (double?) in the long stroke engine than in the short stroke engine. With regard to the loss occasioned by the impulse of the moving parts on the air; it must be admitted that in very slow motions it cannot be very important; nevertheless with a material increase of velocity this source of loss becomes serious; it varies as the extent of surface of the moving parts multiplied into the *square* of the velocity. It is tolerably manifest however that the surface of the moving parts in the long stroke engine, will be, if any thing, greater than in the short stroke engine, and that the velocity of the former will be twice that of the latter; therefore the loss by impulse on the air in the long stroke engine, must be four times that in the short stroke engine.

Beside the foregoing causes, it is doubtful whether there are any others that can produce any material difference in the efficient duty or economical working of a steam engine; at least none that can in any way influence the question now under consideration. In estimating therefore, the advantages of the short and long stroke engines, we have in favour of the former a diminution of loss occasioned by friction, by radiation, by *inertia*, and by impulse on the air; while on the other hand, we have in favour of the long stroke engines, a diminution of loss in the clearance of the piston at the top and bottom of the cylinder. It may be difficult to strike an exact balance between these several sources of loss; but there can be no doubt that in a steam engine the loss by friction is much greater than the loss by all the other causes before mentioned put together; and it is past dispute that the balance of loss as regards these causes, is decidedly against the long stroke engine. (The advantages offered by the short stroke engine as regards diminution of space and weight, although of vast importance, are not here adverted to, because they form no part of the immediate inquiry.)

It may be objected that to select an engine with an 8 feet stroke and a cylinder of only 2½ feet diameter for comparison, is not a fair proceeding, because an engine of such proportions is unusual; and it may be also asked whether, if the principle is further extended by making the stroke only 2 feet, and again doubling the area of the piston, whether the advantage would still be in favour of the short stroke engine?

To this it may be answered that although an engine of 8 feet stroke and 2½ feet diameter of cylinder, may be unusual in this country, it is not so in America; in that part of the world, many engines are employed of very nearly the above proportions, for purposes of steam navigation; and in which engines it is not unusual for the piston to travel at the rate of 300 or 400 feet per minute. Again, as regards the carrying out of the principle by still farther reducing the length of stroke, say to two feet, and increasing the diameter of cylinder proportionately, say to 5 feet; there is no doubt whatever that such an engine would have precisely the same mechanical effect as either of the other two; but the balance of advantages would be against an engine of such proportions; because it would be verging to an extreme on one side as much as the 8 feet stroke engine may be thought extreme on the other side. It may, however, be safely affirmed that the principle applies most powerfully to the case where the diameter of cylinder is the same as the length of stroke; because in that case the proportions are most favourable for the diminution of friction and of radiation, and offer the minimum of disadvantage under the several heads of loss above enumerated.

As it is manifest, therefore, that in all particulars which more immediately affect the beneficial employment or working of a steam engine, the long stroke has no manifest superiority over the short stroke; it may appear strange that so decided a preference should have hitherto been given to the former by the generality of engineers.

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* The friction of the slide is not included, as that will obviously be the same in both engines. See remarks on Friction at the end.

Perhaps this is chiefly to be attributed to the circumstance of the long stroke offering on most occasions greater convenience than a short stroke. Much may be due also to fashion. The earliest application of steam power was for the purpose of pumping water in the course of mining operations, and in this sort of work a good long stroke was found to be attended with considerable convenience and advantage. In blast engines, and many other of the earlier applications of steam power, the same result was manifest; the earlier habits and ideas of engineers were therefore naturally associated with long stroke engines. Moreover, the earlier manufacturers of steam engines had neither good machinery nor good workmen; they could neither depend upon the correctness of their proportions, nor upon the exactness of the workmanship; besides, timber and other inefficient materials were formerly employed to a considerable extent in the construction of engines; from all which causes imperfections and irregularities were numerous in the earlier engines, and they were consequently very inefficient. As all these sources of imperfection and inefficiency operated much more extensively against short stroke engines than against long, it is no wonder that the latter soon obtained a preference, and that the prejudice should still continue to exist, notwithstanding the same causes are no longer in operation. At the present day, with our good materials and workmanship, exact proportions and adjustments, a short stroke engine will be found to work as accurately and as perfectly as a long stroke engine.

There is one very important circumstance to be kept in view as regards long and short stroke engines; which is, that whenever an engine of the latter description has hitherto been made, it has always been considered necessary to keep the cylinder nearly of the same diameter, as in the long stroke engine, and to cause the engine to make a greater number of revolutions in proportion to the shortness of the stroke, so that the piston in every case might travel at a nearly uniform speed of about 200 feet per minute. Now, to a short stroke engine, made on this plan, there may undoubtedly be many objections. The more frequent alternation of the stroke—the greater loss of steam by the more frequent filling of the passages and nozzles, and the clearance at the top and bottom of the cylinder—the much greater angular motion of all the bearings and moving joints, thereby materially increasing friction and wear—are all circumstances tending to lessen the efficiency of a short stroke engine made upon this plan. It is clear however that an engine made upon the principle, herein before laid down, is not open to the same objections.

And, as regard the speed of the piston in engines, whatever may be the length of stroke, being regulated to the uniform standard of about 200 feet per minute, there can be no valid reasons given for such rule; no one can prove that double the above speed, or only one-half that speed, might not be employed with equal or greater advantage; it is certain that in many steam engines of the transatlantic world the pistons move at a speed of 300, 400, and even as much as 500 feet per minute, and no substantial reason can be alleged why such engines should not do good duty; indeed it may be safely affirmed, that whether the speed of an engine be 100 feet, 200 feet, or 300 feet per minute, it matters nothing; provided all the parts of the engines are well proportioned for the proposed speed, the efficient duty and economical use of the engine will be much the same: keeping this always in mind, that *the slow speed will be more favourable for the easy and pleasant working of the engine, and for durability.*

This question may however be asked—Since it is shown that the long stroke has no superiority over a short stroke, but on the contrary that the balance of advantage is rather in favour of the latter, is it intended to recommend the invariable adoption of a short stroke engine to the total exclusion of a long stroke? By no means. All that is contended for is, that in every case a length of stroke should be adopted whether long or short that shall prove to be most convenient, and best adapted to the object for which the engines are to be employed; and that an engineer should not be fettered and cramped by any fallacious abstract notions, that what is termed a long stroke engine must necessarily be more efficient than an engine with a short stroke; and that he should not therefore be obliged to sacrifice many other far more important considerations, for the sake of obtaining in every case the longest possible stroke.

The application of steam power for the purpose of navigation has had such wonderful results, the character of the steam engine has become so greatly changed, and the proportions so altered, that a marine engine of the present day, and a land engine of former times can scarcely be recognised as belonging to the same class of machines. The length of stroke of marine engines is probably not more than half what used formerly to be given to engines of similar power for mining and manufacturing purposes, but still no one can say that this departure from old rules and maxims has been attended with any disadvantage; on the contrary, it can be shown to have been most beneficial and glorious in its results; and if a still further departure from old established notions can be proved advantageous for steam navigation, we can have no reason whatever to regret the change.

There is no question that the ordinary beam engine as employed in steam vessels has proved most efficient, and that in its application it has been productive of vast benefit. If however, by a modification of the existing steam engines, these benefits can be still further augmented, and that in an eminent degree, no consideration ought to stand in the way of the proposed improvements. The great and paramount objects to be aimed at in the construction of steam engines for navigation are the following, viz., the greatest saving of fuel, the greatest saving of space, the greatest saving of weight, and the greatest durability of the machinery. The more eminently the marine engine shall combine the above important qualities, the more nearly will it have arrived at perfection; and much as may be advanced in favour of the beam engines generally used for marine purposes, it cannot be considered presumptuous to declare that the system of engines employed in the "Cyclops" and "Gorgon" Frigates is far superior in all the qualities before enumerated.

It only remains to be stated, that the real question is, not whether the stroke of an engine shall be 8 feet or 4 feet; but relates to a difference of stroke, of probably from 7 feet to 6 feet: that is, whether the reducing of the stroke of a 200 horse engine *one foot*, with a proportionate increase of diameter in the cylinder, can be attended with such injury and inefficiency as shall wholly neutralise or outweigh all the important advantages of the Gorgon Engines.

In conclusion, it should be observed that as regards the ordinary beam engines, there are many circumstances of convenience which render it advisable to make the stroke as long as practicable, *i. e.*, the adopting a tall narrow cylinder instead of a short and wide cylinder; for in the arrangement of the ordinary beam engine for marine purposes, it is evident that a considerable space lengthways is required for conveniently placing the slide jackets and passages, the condenser, the hot-well, and the air pump; this necessarily causes a great elongation of the side levers or beams; there is therefore much local convenience in making the stroke long, and thereby having a tall narrow cylinder instead of a short wide cylinder, less strain is thrown upon the beams; the beams become more close and compact, and afford more space for a passage between and on the off-sides of the pair of engines: the cross-heads and fork-heads become shorter, and have much less strain thrown upon them; these are all very important considerations which clearly indicate the convenience and possible advantage of having as long a stroke as possible in the ordinary beam engine. But in the Gorgon Engine none of these considerations have any influence whatever; here there are neither beams nor cross heads; we can increase the diameter of the cylinder to almost any extent without any local inconvenience whatever.

We shall conclude these observations with the remark, that as it cannot be proved that there is any superiority in a long stroke engine, over a short stroke engine, and as it is also evident that there is no disadvantage whatever in employing a short connecting rod, it is therefore clear that the two objections are decidedly absurd and groundless.

Of the Friction in Steam Engines.

In the preceding pages we have offered an investigation of the comparative merits of the Gorgon, and of the common beam engine; in the course of our remarks it became necessary to advert to the important subject of friction; it will not therefore be deemed misplaced to add a few general remarks upon the nature of the friction, which occurs in a steam engine of the usual construction.

To attempt anything like a correct estimate of the absolute quantity of friction in an engine, would we conceive be very fallacious, because there are so many circumstances which affect the quantity of friction, which are quite beyond the reach of calculation; as for example, the uncertain degree of tightness to which the several bearings or packing may be screwed down—the state of the rubbing surfaces, as to smoothness, polish or roughness—the perfect or imperfect state of the lubrication, &c., all of which are circumstances which have a vast influence on the quantity of friction in a steam engine. From observations which the writer has made he is induced to believe, that in a well made engine, in good working condition, the total amount of friction does not exceed five or six per cent. on the whole power of the engine; but that with no very great change of circumstances this quantity may be increased readily to as much as 10 or 12 per cent.

It happens however that in the preceding investigation, the consideration of the absolute quantity of friction in the engine, is not required; all that is wanted is an estimation of the relative proportions of friction which are due to the several parts of the engines; now this sort of estimation is not very difficult, at all events we can arrive at an approximation sufficiently near for practical purposes.

For, if we assume that all the moving or rubbing surfaces throughout the engine are equally smooth, that all the packings and bearings are uniformly secured down, that all parts are well lubricated; then the comparative quantity of friction in the several parts will be, as the area of one of the rubbing surfaces, multiplied into the distance which it moves up on the other rubbing surface.

We obtain thus the following rules:—

1. For the relative quantity of friction due to the piston, multiply the circumference of the piston by the depth of the packing, and by the distance which the piston moves up and down in the cylinder.

2. For the friction of the main shaft bearings, multiply the square of the circumference by the length of the bearing.

3. For the friction of those bearings which do not revolve entirely round, but oscillate backwards and forwards, as the beam, gudgeons, &c., multiply the area of the bearing into the angular distance moved backwards and forwards during one revolution of the engine, &c.

4. It should be observed, however, that when one of the two rubbing surfaces is hemp packing, the amount of friction will be at least double what it will be when both surfaces are metal.

5. Furthermore, there are certain bearings which receive the direct strain of the engine, while others do not. The following receive the direct strain, viz.; the crank pin, the fork head gudgeons, the main gudgeons, the upper and lower bearings of the side rods; now the quantity of friction upon these several bearings will be considerably more than that which is simply due to the tightening down of the bearings, as before assumed; it is difficult to say what may be the increase of the friction from this cause, but it will be safe to assume that the friction on these bearings will be three times greater than what is due to the other bearings.

Upon the foregoing principles therefore, is calculated the following table of the comparative friction of the different parts of an engine, having a 40-inch cylinder, a 3½-feet stroke, and furnished with the common D slide.

Table of Comparative Friction of the moving parts of a Steam Engine.

2 (rule 4)	125½ in. circum. 4 in. deep 84 in. dist.	84·336		Piston, with hemp packing 4 in. deep, moving a distance of 84 in.
2	13 in. circum. 4½ in. deep. 84 in. dist.	9·828		Piston rod, hemp packing 4½ in. deep, moving 84 in.
2	82 in. circum. 3 in. deep 42 in. dist.	20·262		Air pump bucket, hemp packing 3 in. deep, and moving 42 in.
2	8 in. circum. 3½ in. deep 42 in. dist.	2·352		Bucket rod, hemp packed 3½ in. deep, moving 42 in.
2·2	12 in. circum. 3 in. deep 42 in. dist.	6·048		Two plunger poles, with hemp packing 3 in. deep, moving 42 in.
	15 in. wide 8 in. 2 faces deep 14 in. dist.	10·059	Flat face 1·680	The slide face metal and metal back hemp packed, 6 in. at top, 6 in. at bottom, moving 7 in. each way.
2	24 in. circum. 12 in. deep 14 in. dist.		Back, hemp 8·064	
2	4½ in. circum. 2½ in. deep 14 in. dist.		Slide rod 315	
2	25 in. circum. 9 in. length 25 in. dist.	11·250		The two main shaft bearings moving entirely round metal and metal.
	18 in. circum. 9 in. deep 18 in. dist.	2,268		The bearing at outer end of paddle shaft
3 (rule 5)	15½ in. circum. 6 in. long 15½ in. dist.	4·323		Crank pin, moving entirely round and receiving the direct strain of the engine.
3-2—	10 in. circum. 3½ in. long 2½ in. dist.	·525		The two fork head joints moving at an angle of 45° each way, but receiving the direct stain of the engine.
3-2—	10 in. circum. 3½ in. long 2½ in. dist.	·525		Two lower bearings of side rods same as fork head joints.
3-2—	18 in. circum. 7 in. long 9 in. dist.	6·804		The two main gudgeons receiving the strain of the engines and moving 90° each way.
	45 in. circum. 13¼ in. deep 45 in. dist.	3·543		Eccentric ring moving quite round.
		1·000		Sundry small joints.
		163·123		

Therefore, if it be assumed that the total quantity of friction in a steam engine is as 163·123, then will the relative quantity of friction in the several parts be nearly as is represented by the numbers in the preceding table.

ON THE THEORY OF TOLLS UPON CANALS AND RAILWAYS.

Sir—As I am aware that Mr. Ellett's remarks on Canal and Railway Tolls, extracted in your Journal for September, have attracted some attention, and have been received as sound and judicious principles by some persons, who are in a position which enables them to carry out these principles into practical operation, I beg to offer a few observations, with the view of pointing out what I conceive to be erroneous in Mr. Ellett's statement.

Mr. Ellett's object is, so to regulate the charge of toll upon a canal or railway, as that every part of the country through which the line passes, near or remote, may derive from the improved mode of conveyance the same advantage, an equal share of trade. And he contends that this cannot be effected by the system of tolls that generally prevails, namely, a fixed mileage, or a certain rate per ton per mile; and he therefore recommends the adoption of the directly opposite method, viz., that the lowest charge should be levied on the trade that is brought from the greatest distance, and increasing gradually as we approach nearer to the mart or place of consumption, that the heaviest toll should be charged on that which comes the shortest distance. And Mr. Ellett then proceeds to show that this plan would produce the largest trade, (that is, would command the largest extent of country,) and the greatest amount of revenue.

Now all Mr. Ellett's argument depends upon one little assumption, which he quietly introduces, without remark or explanation, quite unconscious that it contains the grossest fallacy. The market price of any commodity at the place of consumption may be said to be fixed, (for our present purpose,) and, in order to obtain a sale for this commodity brought by the canal or railway, the cost of production and the expense of conveyance must not exceed the fixed market price. Mr. Ellett takes for granted that *the cost of production* is fixed also, and on this rests the whole theory of tolls. "Let us also assume that the cost of producing this article (lumber) is 6 dollars per ton," and the market price being fixed (10 dollars,) he consequently assumes that the extreme cost of carriage which the article can bear, so as to be sold in the market, is fixed too, that it must not exceed 4 dollars, in the instance given. But he assumes also, and it follows in like manner from the preceding assumption, that *the cost of production is fixed*, that the article can always bear this fixed charge of 4 dollars, that whether the commodity be brought from near or far, whether it is carried 100 or 400 miles, it can always bear the full charge of 4 dollars for carriage, and cannot, in any case, afford more. And on this assumption Mr.

Ellett builds his theory,—that as the cost of carriage consists of two parts, the actual expense of conveyance, including the maintenance of the canal or railway, called *the freight*, and the profit of the canal proprietors, called *toll;* and as the freight must necessarily be directly proportional to the distance, the toll (their sum being fixed) should be inversely proportioned thereto.

Even were this principle correct in theory, it would in practice be exceedingly unjust, and therefore injurious. For nothing can be more unreasonable than that the trade which passes along the canal but 50 miles, should pay three times as much toll as that which comes 150 miles, thus paying actually *nine times* its due proportion. Let it be observed also that Mr. Ellett's system is one that can be fully carried out only on such a canal or railway, as has to sustain no competition with common roads. On the latter the charges of conveyance will always be directly proportioned to the distance, and being lowest for the nearest parts, will of course successfully compete with the canal or railway, whose toll is *here* the highest. The maximum charge for conveyance being 4 dollars, and supposing with Mr. Ellett that land carriage is five-fold more expensive than by the "improvement," it will, according to the scale given by him, be cheaper than the canal for the first 40 miles, (one-tenth of its whole length,) and from so much of the country, therefore the canal will derive no trade. With us the proportion of the cost of land and canal carriage is much nearer, perhaps greater than two to one; and the portion of the country commanded by the superior cheapness of land carriage, under Mr. Ellett's system of tolls, will be proportionately larger. Wherever there is the competition of another conveyance, on which the charges are made according to the distance, the inverse system of toll will be impracticable.

Leaving, therefore, for the present, the practical objections to Mr. Ellett's proposed system, I turn again to that which forms the basis of his whole theory, and which I conceive to be a most fallacious assumption. I am indeed surprised that any one writing upon such a subject, who ought to have some acquaintance with the principles of Political Economy, should hazard, or should carelessly make, an assumption so opposed to the mere elements of that science, as well as to ordinary experience. So far from *the cost of production* of any article being a fixed sum, throughout an extensive district of country, it is dependent upon, and varies exceedingly with, a great many circumstances. Every one knows that there is a difference of prices in many markets throughout the kingdom, and the price *at the place of production* is, *generally*, the actual cost of production, added to the usual profits. For reasons which will be noticed hereafter, the cost of production, and consequently, prices differ less in an improved country like England, than in one possessed of fewer artificial advantages, such as America or Ireland. But the fact is notorious to every one, that differences do exist in the expenses of production, at different places, of commodities of the same quality, and of equal value at the place of consumption.

The cost of production is made up chiefly of rent, the wages of labour, and the profits of the producer, (and, in manufactures, of the price of the raw material.) *Rent* is well known to vary exceedingly in different parts of the country, even for lands of the same kind, and equal fertility. *Wages* differ too, not only between the manufacturing and agricultural districts, but also between different districts engaged in the same occupations. Profits differ likewise, but being nearly in a fixed proportion to the total cost, they need not be considered separately. As, then, the component parts of the cost of production thus vary throughout the country, their sum, the total cost, cannot be said to be fixed. Yet Mr. Ellett seems to have forgotten these facts, palpable as they are to every man's observation.

There are, however, certain articles whose value is very small, and the cost of production of which consists merely of the wages of the labour employed upon it; and this labour being of the coarsest kind, its wages vary but little. Of such commodities the expense of production cannot differ much, and may be said to be fixed. Such are stone, lime, and, in a wooded country like America, timber, and perhaps coal, ores, &c. It is to such products Mr. Ellett chiefly applies his theory, but he does not confine it to them. He intimates that some other principles come into operation with reference to the more valueable articles of trade. But as I have not seen his observation on that part of the subject, and as it appears to me that his principle, if correct, must be equally applicable to every branch of trade, and as I know that it has been so interpreted and applied by some of his readers, I have discussed the subject generally, endeavouring to refute the theory in its application to either division of canal trade. In certain cases, then, it would appear that Mr. Ellett's assumption is correct, that the cost of production is fixed (or nearly so). But it so happens, that in these instances, our author's system of tolls would be altogether impracticable. The commodities are of such little value as to be scarc worth removing, unless at a very small cost; they cannot, in general, be brought from a distance, the necessary charge for freight, even if there be no toll, acting as a prohibition; and to have any trade, even from the nearest places, you must levy only the lowest rate of toll. Thus on the Irish Grand Canal the toll on stone is 6*d*. per ton, and on manure 4*d*. per ton for any distance,—because at higher rates they would scarcely be carried at all. And here, it is evident, there is no room for graduation according to Mr. Ellett's plan.

But resuming the consideration of the cost of production, where it is not fixed, let us examine into the causes of the differences that exist; why rent is high in one district, and low in another, and why wages vary so much as they are found to do in different parts of the country. Of course they all depend upon the economical principle of the relation of supply and demand. But in the same country, all parts of which are subject to the same laws and conditions of trade, and all contribute to the supply of the same great market, this relation between the supply and demand, that is the different values of rent and wages in the various parts of this district, depends mostly upon their respective distances from the place of consumption, and the facilities of conveyance thither. Near a large town, rent and wages, and consequently the cost of production, are high, because there the great demand can be most easily supplied, and with very little expense for carriage. Farther off, as the cost of conveying the products to the markets increase with the distance, both rent and wages are lower. And if a canal or railroad be made into the country, as it cheapens the cost of conveyance, and thereby facilitates its supplying the market, it raises rent and wages, or the cost of local production. Thus the true state of the case is very different from Mr. Ellett's theory. The cost of production is not fixed; it is found to depend on the charges for conveyance, varying inversely with them, (not in the same ratio,) that is, with the distance. Of course I speak here of the natural charge for conveyance, which consists of *freight* only, and is always proportionate to the distance. Such is the cost of carriage upon common roads, and as these are generally the first modes of conveyance, and the most universal, it is by the principles and circumstances that relate to them the cost of production is generally governed. In England the facilities for transport are so great, and so equally diffused throughout every part of the country, that the difference in the cost of production in different places is small, as I before mentioned. But in countries where the improved methods of conveyance are few, the difference of price, or the cost of production, at places at unequal distances from the market, or not having the same facilities, is often very striking. In Ireland, the price of potatoes, for instance, is frequently found to differ to an astonishing degree, in various parts more or less remote from the large towns; and the only cause appears to be the expense of carriage, which being in proportion to the distance, increases or diminishes the cost of production and the facility of removal.

If, then, the cost of production is found to vary, and inversely with the distance, the difference between it and the market price is not fixed, but varies directly with the distance; and the total sum which the commodity will bear as the cost of conveyance to the market is a varying quantity, increasing with the distance. The freight, one of its parts, is proportioned to the distance, and the other portion, the toll, should also, in general, be regulated by the same proportion. There are, of course, many circumstances which modify this law, at least in practice; but looking at the abstract question, I think that the theory of tolls, which the principles of economy and the laws that govern the relations of value and price indicate, is the simple, natural, and just system of charging according to the distance, in proportion to the benefit conferred, or to "the value given."

This is not only the true theory, but it is also the only system that is practicable, wherever there is the competition of common roads; it is easy to show that, in all cases, it would be the most profitable system also,—the most productive of revenue to the proprietors of the canal or railway; and at the same time the most impartial, and the most equally advantageous to every part of the country. Each district has its own advantages, in which it is superior to the others, and, under a natural system, its facilities for production and transport are proportioned duly to its means; while the retrograde principle must have the effect of encouraging the remoter districts, and depressing the nearer,—by destroying the natural and equable balance, which prevails in the social commonwealth.

I cannot trespass on your space, Sir, by entering further on the proofs that the natural system is also the most productive; neither could I do so without introducing diagrams, which would be found to differ very much indeed from those of Mr. Ellett. I shall only add, that I hold the true and most effectual mode of gaining for a canal or railroad the largest amount of trade and revenue to be MODERATE TOLLS, charged fairly according to the distance. I am convinced that the charges upon most canals and railways are much too high; that considerably lower rates would greatly increase their prosperity, and add vastly to the resources and commercial facilities of the country. Wherever the experiment of reduction has been tried, I believe it has proved successful, in augmenting the trade and its profits; and I have no doubt that soon the proprietors of many public works will be compelled, for their own sakes, to resort to such measures; and it is, therefore, of much importance that the principles of "the theory of tolls" should be clearly understood; and, conceiving that those advocated by Mr. Ellett are fallacious, unjust, and injurious, I have endeavoured to refute them,—and regret that the task has been so feebly and hastily performed.

C. E. B.

ON COMPETITION DESIGNS.

We receive many letters on the subject of Competition, which are almost unanimous in complaining of the UTTER WANT OF GOOD FAITH on the part of those who invite architects to send in designs. And though we are sorry there should be room for such complaint in any instance whatever, we are glad to find that the evil itself prevails to so shameful an extent, because it is now likely that the profession will be stirred up to adopt some decisive measures to correct it. They certainly ought to do so; and we should advise a public meeting to be convened by them for that purpose. In the meanwhile our own pages shall be open to the exposure of the impositions now practised under the mask of Competition; and no doubt, many a strange tale might be unfolded that would open the eyes of the public to the mysterious doings of those Secret Tribunals which exercise an arbitrary and irresponsible power, and generally no less injuriously to the interests of architecture and good taste, than unjustly towards individuals in the profession.

From among the letters addressed to us on the subject, we give the three following as being well worthy of the attention of our readers, though we dare not promise the writers that their remonstrances will produce any effect.

Sir—The exposure made by your correspondent K. P. S. relative to the Bury St. Edmund's affair, ought to produce some good effect, yet that any is likely to result from it is more than can reasonably be anticipated; for not only are committees—even though composed of "all honourable men," perfectly callous to any thing like shame, but there is a sad want of energy in architects themselves, or they would even now have taken some decided steps to check the scandalous abuses—I may say, the barefaced impositions and deceptions attending competitions.

If there is positively no remedy for the evils complained,—why then in the name of common sense let them be endured, without any pitiful whining on the part of those who choose to lend themselves to a system of humbug.—Well, I have said *humbug*, and although that word is certainly not the most delicate, there is hardly another in the language that would be so appropriate, unless it were one more offensive still.—But remedy I am persuaded there is—at least to a very great extent, provided we choose to adopt such measures as will secure it. No doubt, there are many difficulties to be first overcome; but that, I conceive is a reason the more, why they should be boldly encountered, and the task of reform be set about with fearless resolution. Such reform ought to have been carried through by the Institute; because that Body might have taken up the matter actively without incurring the invidiousness and risk to which individuals might expose themselves by so doing. There was, indeed, an attempt of the kind, and a most feeble one it was,—amounting to nothing more than a little *palavering*. It would therefore have been greatly more to the credit of the Institute, had the subject never been brought forward at all; because now it looks as if the present vile system of competition was formally acquiesced in by those who ought to leave no stone unturned until they correct it. But there have been two other opportunities which, had they been properly turned to account, might have gone far towards bringing about the so-much-desired reform. As you will perhaps anticipate, I allude to the Nelson Monument and Royal Exchange Competitions, in both of which those who engaged in them, suffered themselves to be more injuriously and contemptuously treated, without venturing to protest against it. With regard to the first one, nothing could be a more insulting piece of mockery than the pretended Second Competition—without any warning on the part of the Committee, that they were decidedly in favour of some kind of Column;—although the result too plainly shows that they were predetermined to adopt Railton's design;—for had they not been so predetermined, they would at least have decently expressed their regret that they should have been driven into so particularly awkward a situation, being under the necessity of confirming their first choice, though aware that it would be in opposition to public opinion. No explanation, however, was offered—and what is much more, none was demanded by the Competitors.—Pity would be thrown away upon such pusillanimous creatures; for they have shown that they deserved to be kicked.

Had a bold and resolute stand been made then,—and the public would almost to a man have supported them;—had they called the Nelson Committee to account, and let the latter know that they were not wholly irresponsible; there can be no doubt but that it would have served as a most wholesome warning to the Gresham Committee, and the Royal Exchange competition would have been conducted very differently from what it has been. But in that, too, the Competitors have allowed themselves to be kicked like spaniels; and the authors of the Eight Designs which obtained the approbation of the professional umpires, suffered themselves to be set aside, and not permitted to try their strength again!

Tame, spiritless, pluckless! they have been served rightly, but THE CAUSE!—that has been most cowardly betrayed. Had those competitors been firm, the Committee would have chaunted *Peccavimus* in full chorus. Had not those Competitors been milk-livered the Committee would have blushed like boiled lobsters. But now, *Actum est! Perii!* And with such a memorable example—such a fatal precedent before them, future Committees may laugh at both competitors and the public.—There is but one chance left: and that is to urge Reform in Competition, incessantly; to discuss it in every possible shape, and without intermission;—and, not least of all, to insist in future upon Pre-exhibition of Designs,—not for merely a day or two, but for sufficient length of time, according to the number of drawings.

I remain, &c.

P. S.

Sir—Apropos to the subject of Competition there is an anecdote now circulating of so extraordinary a nature that it ought to be either publicly confirmed, or publicly contradicted. Reporting it, just as I heard it, the case is this: from among the designs sent in for the Protestant Memorial at Oxford, that by Mr. Blore was *unanimously* chosen, consequently whether such selection was actually the very best or not, it is evident that it was judged to be so by those who made it. But they afterwards discovered to their astonishment and mortification that they had clapped the saddle on the wrong horse, for misled by the name, they had decided in favour of that design, taking for granted that it was by *the* Mr. Blore who has been employed at Buckingham Palace, &c. As soon therefore as they detected their error, and ascertained that *their* Mr. Blore was a different individual, and one comparatively unknown in the profession, they came to the worthy resolution of setting aside the design, which had previously been approved of by them merely through *mistake!* Is not this a most delicious anecdote? Does it not speak volumes as to the sort of discrimination, and the kind of integrity and good faith, displayed by *gentlemen* on such occasions? And mark you, I pray, this extraordinary tergiversation was not manifested in a paltry hole-and-corner competition in some obscure town and village, but in—Oxford!—the seat of learning, and of orthodoxy.

Unless the matter is altogether misrepresented—in which case it becomes the duty of those who are concerned in it, to clear themselves from so highly injurious a charge,—Mr. Blore has sufficient grounds for bringing his action for damages against his quondam judges; and would no doubt obtain them to a very heavy amount, because he has not only suffered pecuniarily, but may be said to have been stigmatised in his professional character, having been formally set aside as incompetent, consequently placed in a very different situation from the other unsuccessful competitors.

Delenda est Carthago: the Humbug and Deception now attending Competition must be blown up,—the present system must be entirely reformed; and as the Institute will not exert itself at all in the cause, so much the more manfully must individuals do so. The pen and the press must bring the subject continually before the profession and the public, until both shall be completely roused: and then, perhaps, when the needed reform shall have been commenced by others, the Institute will valiantly profer their services, and come forward to share in the merit of the victory.

I remain, &c.

J. P. M.

Sir—In the No. for this month of your excellent Journal, there is an article on Architectural Competition signed "K. P. S," in which some "facts" are detailed relative to that subject, especially as relates to a church to be built or now building at Berry.

If "K. P. S." was aware of how these matters are managed with us in Ireland, it might excite his honest indignation still more, as the system generally adopted here is to place all the competition designs submitted into the hands of a favoured architect, from which to choose and model such plans as the committee may direct, who *kindly* indulge the favourite with the necessary time.

It may be supposed that the writer is a disappointed candidate, and that this is merely the ebullition of his chagrin and mortification from defeat. Not so; for having had the benefit of seeing the fate of others on these occasions, he has invariably steered clear of this species of competition.

An instance of the flagrant injustice done in this way took place a short time since, wherein architects were invited by public advertisement to send in plans for an edifice to be erected near Dublin, to be appropriated as a place of worship. After the plans, &c., had been sent in, considerable shuffling took place on the part of the committee. At length, after frequent postponements and delays, it was announced that none of the designs, in their judgment, were suitable to the required building, although they numbered upwards of a dozen designs, some of which were shown to me previously, and possessed (in my opinion) very great merit, and were in strict accordance with the rules laid down in the advertisement. In a short time afterwards the building was begun, after the design and inspection of an architect who had not competed, and as the building is now nearly completed, I can, without fear of contradiction, assert that it is a "fac simile" (as far as I have been able to examine it) of one of the designs I had been shown, and which was sent in to the committee.

The profession of an architect is completely degraded in Ireland; for instance, in the erection of any county public building (the architect, if indeed any be engaged at all) is merely a subordinate to the county surveyor, who, with very few exceptions, know nothing of our profession, and until the clause which relates to this subject in the present Grand Jury Act is remedied, things must remain in this state. At present every public work is placed in their hands, and, generally speaking, when anything architectural (or at least what should be architectural) is to be done, they attempt it themselves, and a pretty finish they make of it, instances of which are but too numerous.

Again, a paragraph is now going the round of our papers, eulogizing a new Saving's Bank erected in Limerick, "*by Sir Thomas Deane, the* EMINENT ARCHITECT, *the progress of the work was superintended by William H. Owen, Esq.*, CIVIL ENGINEER, *whose professional taste and skill are so highly appreciated.*"

Not wishing to occupy too much space in your valuable journal, I have merely glanced at some of the strange doings perpetrated here, which, if properly "*shown up*," would undoubtedly throw the grievances complained of by K. P. S. into the shade.

I am, Sir,
Your very obedient servant,
Dublin, Oct. 12, 1840. J. A., Architect.

LAND SURVEYING.

SIR—I should not trespass on your very valuable time, and on the pages of your most deservedly popular Journal, did I not know that you make it your study to give publicity to every thing, however trifling, which may be of use to any member of the profession, whose interests you so very ably advocate on all occasions. Should this obtain your approval, your insertion of it will much oblige the writer.

It has, I dare say, occurred to every one engaged in an extensive survey, that there is a great danger of mistakes taking place in the change of pins in a long chain line; as the number of changes or removes must be kept in memory, and one is very likely to become confused if there are a great many of them. To obviate this inconvenience, I would beg to propose a very simple plan, viz., that the leader should be provided with a small bag, containing a number of common marbles, such as school-boys employ in their games; and that on giving up his pins to the follower, or hind chainman, at every remove, he should give him one of these marbles, to be kept by the follower in another bag provided for the purpose, until they arrive at the end of the line; when each marble will stand for 10, and the pins in the follower's hand, as usual, for single chains.

By this method nothing is left to the memory, and of course a greater degree of certainty is obtained.

I have the honour to remain, Sir,
Your most obedient servant,
Dublin, Oct. 3, 1840. E. WILLIAM MANSELL.

LAND SURVEYING.

SIR—I observe in your last Number an extract from Mr. Bruff's Treatise on Engineering Field Work, wherein he says, in describing the new instrument for measuring the contents of maps, that "the principle of the plan has been long known to some few suveyors, but that they prudently kept it to themselves, &c." Now, Sir, I should very much like to know the names of any surveyors to whom the instrument was known before its introduction into the Tithe Office, and perhaps Mr. Bruff will be good enough to afford this information through the medium of your Journal, as it is certainly important to know to whom surveyors are indebted for the invention of this instrument, which most justly deserves all the praise that can be bestowed upon it.

I beg it to be understood, that in seeking this information from Mr. Bruff, I am actuated by no hostile or cavilling spirit, on the contrary, I think generally the contents of his work are most valuable, and strictly to be depended on; in this instance, however, I think he is misinformed, and believing that Mr. Bruff would not wish to deprive the inventor of his due share of credit, I trust he will have no hesitation in stating publicly, who are the parties to whom he alludes, as having long known the principle of the plan.

I am, Sir, your obedient servant,
AN OLD SURVEYOR.
London, Oct. 15, 1840.

THE NELSON AFFAIR.

MR. EDITOR—I send you some stanzas which you may, if you like, suppose were intended to have been put into the foundation stone of Railton's Column, but somehow or other escaped that honour; allow them therefore to be preserved in one of your columns.

ANTI-STYLITES.

NELSON *loquitur*:—

You see that I stick to my *post*,
Stuck up here on the top of a peg,
And having before but one arm,
I am now left to stand on one leg.

Though not on a leg made of wood,
Oh no!—'tis a leg built of stone;
And so wondrous tall too it is,
That I stand "all aloft and alone,"

Just after that whimsical fashion
Old Simeon adopted of yore;
But then he was a saint most sublime,
And his practice a bit of a bore.

Yes, my case is confoundedly hard,
Tho' some other folks' heads are quite soft,
So I wish they had left me *alone*,
Before they had left me *aloft*.

For Wightwick I see there is sneering,
While others are laughing outright,
And folks seem myself to be queering,
While they gape at my pitiful plight.

O! were but the stick I am stuck on,
A good walking-stick—by my fay,
I would not stand here to be quizzed at,
But with stick and all *walk away*.

PNEUMATIC OR ATMOSPHERIC RAILWAY.

SIR—The fairness that should guide a public Journalist, and a scientific one especially, will doubtless induce you to afford me a place to reply to an invidious article contained in your Journal for July, which does me great injustice—has an injurious tendency, and at the same time confers approbation on Messrs. Clegg and Samuda, who are endeavouring to avail themselves of the result of information communicated to them, whilst they were confidentially employed by me in 1836-7-8, in the construction of works and machinery designed for carrying into practical operation the pneumatic or atmospheric railway, which was intended to be applied on the Birmingham, Bristol, and Thames Junction Railway at Wormwood Scrubs, as the first prospectus of that railway (1835) will show, and on which line my invention is now pirated by Clegg and Samuda.

The article in your Journal appears intended as a disparagement of my invention. I have before publicly accused those persons of the conduct complained of in the Sun newspaper of the 17th and 19th June last. I am preparing to stop their proceedings through the medium of a court of justice, but that is no ground for my sustaining in the mean time injurious remarks, and the public mind abused through the columns of public journals.

I am prepared to prove that the system carried into effect, even in all its minute details, is wholly my invention; as well as the more improved applications of the same principle, as specified in my patents of 1834 and 1836, all of which are legally held by me under the authority of the Patent Laws, which forbid those persons or others from using any portion of that which is described in the article inserted in your Journal.

In regard to the remarks that "the idea of employing the power of the atmosphere against a vacuum created in an extended pipe laid between rails, and communicating the moving power thus obtained to propel carriages travelling on a road, we believe originated with Mr. Medhurst, in 1827, and that in 1812 he published some ideas on this method." And that "about 1835 some experiments were made with a model in Wigmore-street, by Mr. Pinkus, very similar to those described by Mr. Medhurst; these experiments, however, failed from the same cause probably, which prevented Mr. Medhurst from carrying his into effect, viz., the impossibility of making an air tight communication from the inside of the pipe to the carriage, tight enough to allow a useful degree of rarefaction to be produced."

Now, Sir, I have to complain that not even so much as one particular of all the allegations in the above quotations is true, and declare that I can disprove them all by documentary evidence of record, and printed publications of old dates. Myself an humble labourer in the field of science, I trust I shall never be guilty of that meanness of mind that would detract from another the merit justly due to him for any mental production, and I will contend for equal justice to myself.

First, then, the merit, and it is a high one of "employing the power of the atmosphere against a vacuum," and transmitting that power, as well as the suggestion of obtaining a similar power by plenum (the latter though impracticable) is due to the celebrated Papin, who suggested them 120 years ago, and not Mr. Medhurst.

Second. The suggestions and the experiment "employing the power of the atmosphere against a vacuum, and by impelling a piston through a tunnel," is due to Mr. Valance, who did it at Brighton in 1824, and not to Mr. Medhurst, who in 1810 only proposed the *impractical part of Papin's plan of forcing air under the compression of many atmospheres*, as several others before him had done; and added at a subsequent date the idea of moving a piston through *an underground tunnel*, by forcing in *air behind it*, from distances of 20 miles apart, and so impel goods and passengers therein. In 1824 Mr. Valance took out a patent for his method of an *underground tunnel*, and the *more correct and practical principle* of rarefaction and atmospheric pressure.—Mr. Medhurst, who held no patent, made claim to Mr. Valance's invention of transmitting a piston through an underground tunnel.—Mr. Valance in a pamphlet of that date, answered Mr. Medhurst, and pointed out in what his invention differed from the other's claims; thus both Papin and Valance went before Mr. Medhurst.

In 1825, not 1835 as is alleged, I proposed to apply Papin's principle by a new method, combination of apparatus and machinery, whereby I was enabled to transfer the power generated under *partial vacuum to the exterior of extended* mains or pipes laid on the margin of a canal or railway, and transmitting the power so generated along such main. I combined the main with a canal, and proposed to use Brown's Gas Vacuum Engine as the prime mover, my plans and specifications were recorded, my models constructed and exhibited; these contained such a mechanical arrangement for effecting a propelling power under rarefaction, *as alone admits of its application at all;* subsequently they became the subject of the first patent (1834) ever taken out for that object. As I was for the first time informed in 1836, Mr. Medhurst in 1828 reprinted his pamphlet of 1810, for the Underground Tunnel and the application of a *Plenum*, and with it, now for the first time proposed to transfer the power to the outside of the underground tunnel, and to have stationary engines 20 miles apart for forcing in air, he shewed a lithographic drawing of the method, and having 4 years before claimed the plan of Valance, and 3 years before of my method of transferring the power of partial vacuum to the exterior of a main, he proposed a long box and a pipe suspended over a channel of water in order to make a water-joint; these suggestions made at that late date, were nevertheless so crude and undigested, as to be utterly impracticable as they show. His calculation based upon them he can in no way obtain. He never made an experiment, as I am well informed, and his pamphlet was in the hands only of private friends; I saw one, for the first time, in 1836. Having been engaged until 1830, I in that year again prepared fresh plans and specifications, such as are now enrolled, and exhibited them to friends. In 1833 I commenced my patent, sealed in 1834, and in that year constructed a large working model that was publicly exhibited, *and upon its success in* 1835 an association for working my system was formed, which is now extant; contracts were made for works to demonstrate the principle with my subsequent improvements, for which patents also were taken out in various countries. The works were designed to be applied on the Birmingham Bristol and Thames Junction Railway, at Wormwood Scrubs; those works were nearly completed, the line half a mile in length formed on the margin of the Kensington Canal, which was united with that line of railway. Samuda and Hague were the contractors for the engines, the former as well in the construction of the pneumatic mains and valve, and Samuel Clegg was confidentially employed and consulted, and witnessed the progress of the experiments during such employment, learned from me all the minute details that they have now carried into effect, but which are nevertheless held by me under patents. Clegg and Samuda saw my experiments in 1835-6 made upon rough models, but which were attended with perfect success, only some of the details were purposely omitted until further patents were sealed.

Not only, therefore, is the invention in all its details my own, and legally held by my patents, which embrace such mechanical combinations, as without which that well known principle cannot possibly be carried into effect, but I shall, when my interest best requires it, stop their further progress.

I am, Sir, your obedient servant,

H. Pinkus.

11, *Panton Square, Aug.* 20, 1840.

MUSEUM OF ECONOMIC GEOLOGY,

CRAIG'S COURT, CHARING CROSS, LONDON.

(Extract from the President's Address of the Geological Society of London.)

Among the most important of the remarkable events of the past year, we recognise with gratitude and confident anticipation of great advantage, both to science and the arts, the establishment by her Majesty's government of an institution hitherto unknown in England, namely, a Museum of Economic Geology. This is to be freely accessible to the public at stated periods, in the department of her Majesty's Woods and Forests, and Public Works, for the express object of exhibiting the practical application of geology to the useful purposes of life. In this Museum, a large store of valuable materials has already been collected and arranged, chiefly by the exertions, and under the direction of Mr. De la Beche. In it will be exhibited examples of metallic ores, ornamental marbles, building stones and limestones, granites, porphyries, slates, clays, marls, brick earths, and minerals of every kind produced in this country, that are of pecuniary value, and applicable to the arts of life. Information upon such subjects, thus readily and gratuitously accessible, will be of the utmost practical importance to the miner and the mechanic, the builder and the architect, the engineer, the whole mining interest, and the landed proprietors. The establishment will contain also examples of the results of metallurgic processes obtained from the furnace and the laboratory, with a collection of models of the most improved machinery, chiefly employed in mining. A well-stored laboratory is attached to this department, conducted by the distinguished analytical chemist, Mr. Richard Phillips, whose duty it already is, at a fixed and moderate charge, to conduct the analysis of metallic ores, and other minerals and soils submitted to him by the owners of mines and proprietors of land, who may wish for authentic information upon such matters.

The pupils in this laboratory are already actively employed in learning the arts of mineral analysis, and the various metallurgic processes.

A second department in the Economic Museum, will be assigned to the promotion of improvements in agriculture, and will contain sections of strata with specimens of soils, sub-soils, and of the rocks from the decomposition of which they have been produced.

To this last-mentioned collection, proprietors of land are solicited to contribute from their estates labelled examples of soils, with their respective sub-soils; and all persons who wish for an analysis of any sterile soil, for the purpose of giving it fertility, by the artificial addition of ingredients with which nature had not supplied it, may here obtain at a moderate cost, an exact knowledge of its composition, which may point out the corrective additions which it requires. This portion of the Museum will more especially exhibit the relations of geology to agriculture, in so far as a knowledge of the materials composing the sub-strata may afford extensive means of permanent improvement to the surface.—*Phil. Mag., October*, 1840.

St. James's Park.—An ornamental building in the Swiss style, consisting of council-room, bridge, and keeper's cottage, is now building in St. James's park for the Ornithological Society of London. The site is nearly opposite the Horse Guards, and the design, approved by the Board of Works, has been prepared by Mr. Watson, under whose direction it will be completed.

AN ACT FOR REGULATING RAILWAYS.

PASSED AUGUST 10, 1840.

No railway to be opened without notice to the Board of Trade.—Whereas it is expedient for the safety of the public to provide for the due supervision of railways: be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, that, after two months from the passing of this Act, no railway, or portion of any railway, shall be opened for the public conveyance of passengers or goods until one calendar month after notice in writing of the intention of opening the same shall have been given, by the Company to whom such railway shall belong, to the Lords of the Committee of Her Majesty's Privy Council appointed for trade and foreign plantations.

Penalty for opening railways without notice.—And be it enacted, that if any railway, or portion of any railway, shall be opened without due notice, as aforesaid, the Company to whom such railway shall belong shall forfeit to her Majesty the sum of 20*l.* for every day during which the same shall continue open, until the expiration of one calendar month after the Company shall have given the like notice as is herein-before required before the opening of the railway; and any such penalty may be recovered in any of her Majesty's courts of record.

Returns to be made by railway companies.—And be it enacted, that the lords of the said committee may order and direct every railway company to make up and deliver to them returns, according to a form to be provided by the lords of the said committee, of the aggregate traffic in passengers, according to the several classes, and of the aggregate traffic in cattle and goods respectively, on the said railway, as well as of all accidents which shall have occurred thereon, attended with personal injury, and also a table of all tolls, rates, and charges from time to time levied on each class passengers, and on cattle and goods conveyed on the said railway; and if the returns herein specified shall not be delivered within thirty days after the same shall have been required, every such company shall forfeit to her Majesty the sum of 20*l.* for every day during which the said company shall wilfully neglect to deliver the same; and every such penalty may be recovered in any of her Majesty's courts of record; provided always, that such returns shall be required, in like manner and at the same time, from all the said companies, unless the lords of the said committee shall specially exempt any of the said companies, and shall enter the grounds of such exemption in the minutes of their proceedings.

Penalty for making false returns.—And be it enacted, that every officer of any company who shall wilfully make any false return to the lords of the said committee shall be deemed guilty of a misdemeanor.

Board of trade may appoint persons to inspect railways.—And be it enacted, that it shall be lawful for the lords of the said committee, if and when they shall think fit, to authorize any *proper* person or persons to inspect any railway; and it shall be lawful for every person so authorized, at all reasonable times, upon producing his authority, if required, to enter upon and examine the said railway, and the stations, works, and buildings, and the engines and carriages belonging thereto: *provided always, that no person shall be eligible to the appointment as inspector as aforesaid who shall within one year of his appointment have been a director or have held any office of trust ar profit under any railway company.*

Penalty on persons obstructing inspector.—And be it enacted, that every person wilfully obstructing any person, duly authorized as aforesaid, in the execution of his duty, shall, on conviction before a justice of the peace having jurisdiction in the place where the offence shall have been committed, forfeit and pay for every such offence any sum not exceeding 10*l.*; and on default of payment of any penalty so adjudged, immediately or within such time as the said justice of the peace shall appoint, the same justice, or any other justice having jurisdiction in the place where the offender shall be or reside, may commit the offender to prison for any period not exceeding three calendar months, such commitment to be determined on payment of the amount of the penalty; and every such penalty shall be returned to the next ensuing court of quarter sessions in the usual manner.

Copies of existing bye-laws to be laid before the board of trade; otherwise to be void.—And whereas many railway companies are or may hereafter be empowered by Act of Parliament to make bye-laws, orders, rules, or regulations, and to impose penalties for the enforcement thereof, upon persons other than the servants of the said companies, and it is expedient that such powers should be under proper control; be it enacted, that true copies of all such bye-laws, orders, rules, and regulations made under any such powers by every such company before the passing of this Act, certified in such manner as the lords of the said committee shall from time to time direct, shall, within two calendar months after the passing of this Act, be laid before the lords of the said committee; and that every such bye-law, order, rule, or regulation, not so laid before the lords of the said committee within the aforesaid period, shall, from and after that period, cease to have any force or effect, saving in so far as any penalty may have been then already incurred under the same.

No future bye-laws to be valid till two calendar months after they have been laid before the board of trade.—And be it enacted, that no such bye-law, order, rule, or regulation made under any such power, and which shall not be in force at the time of the passing of this act, and no order, rule, or regulation annulling any such existing bye-law, rule, order, or regulation which shall be made after the passing of this Act, shall have any force or effect until two calendar months after a true copy of such bye-law, order, rule, or regulation, certified as aforesaid, shall have been laid before the lords of the said committee, unless the lords of the said committee shall, before such period, signify their approbation thereof.

Board of trade may disallow bye-laws.—And be it enacted, that it shall be lawful for the lords of the said committee, at any time either before or after any bye-law, order, rule, or regulation shall have been laid before them as aforesaid shall have come into operation, to notify to the company who shall have made the same their disallowance thereof, and in case the same shall be in force at the time of such disallowance, the time at which the same shall cease to be in force; and no bye-law, order, rule, or regulation which shall be so disallowed shall have any force or effect whatsoever, or, if it shall be in force at the time of such disallowance, it shall cease to have any force or effect in the time limited in the notice of such disallowance, saving in so far as any penalty may have been then already incurred under the same.

Provisions of Railway Acts requiring confirmation of bye-laws repealed.—And be it enacted, that so much of every clause, provision, and enactment in any Act of Parliament heretofore passed as may require the approval or concurrence of any justice of the peace, court of quarter sessions, or other person or persons, other than members of the said companies, to give validity to any bye-laws, orders, rules, or regulations made by any such company, shall be repealed.

Board of trade may direct prosecutions to enforce provisions of Railway Act. Notice to be given to the company.—And be it enacted, that whenever it shall appear to the lords of the said committee that any of the provisions of the several Acts of Parliament regulating any of the said companies, or the provisions of this Act, have not been complied with on the part of any of the said companies, or any of their officers, and that it would be for the public advantage that the due performance of the same should be enforced, the lords of the said committee shall certify the same to her Majesty's attorney-general for England or Irelaad, or to the lord advocate for Scotland, as the case may require; and thereupon the said attorney-general or lord advocate shall, by information, or by action, bill, plaint, suit at law or in equity, or other legal proceeding, as the case may require, proceed to recover such penalties and forfeitures, or otherwise to enforce the due performance of the said provisions, by such means as any person aggrieved by such non-compliance, or otherwise authorized to sue for such penalties, might employ under the provisions of the said acts: provided always, that no such certificate as aforesaid shall be given by the lords of the said committee until twenty-one days after they shall have given notice of their intention to give the same to the company against or in relation to whom they shall intend to give the same.

Prosecutions to be under sanction of board of trade, and within one year after the offence.—And be it enacted, that no legal proceedings shall be commenced under the authority of the lords of the said committee against any railway company for any offence against this act, or any of the several Acts of Parliament relating to railways, except upon such certificates of the lords of the said committee as aforesaid, and within one year after such offence shall have been committed.

Punishment of servants of railway companies guilty of misconduct.—And be it enacted, that it shall be lawful for any officer or agent of any railway company, or for any special constable duly appointed, and all such persons as they may call to their assistance, to seize and detain any engine-driver, guard, porter, or other servant in the employ of such company, who shall be found drunk while employed upon the railway, or commit any offence against any of the bye laws, rules, or regulations of such company, or shall wilfully, maliciously, or negligently do or omit to do any act whereby the life or limb of any person passing along, or being upon the railway belonging to such company, or the works thereof respectively, shall be, or might be injured or endangered, or whereby the passage of any of the engines, carriages, or trains shall be or might be obstructed or impeded, and to convey such engine-driver, guard, porter, or other servant so offending, or any person counselling, aiding, or assisting in such offence, with all convenient despatch, before some justice of the peace for the place within which such offence shall be committed, without any other warrant or authority than this act; and every such person so offending, and every person counselling, aiding, or assisting therein as aforesaid, shall, when convicted before such justice as aforesaid, (who is hereby authorised and required upon complaint to him made, upon oath, without information in writing, to take cognizance thereof, and to act summarily in the premises), in the discretion of justice, be imprisoned, with or without hard labour, for any term not exceeding two calendar months, or, in the like discretion of such justice, shall for every such offence forfeit to her Majesty any sum not exceeding 10*l.*, and in default of payment thereof shall be imprisoned, with or without hard labour as aforesaid, for such period, not exceeding two calendar months, as such justice shall appoint; such commitment to be determined on payment of the amount of the penalty; and every such penalty shall be returned to the next ensuing court of quarter sessions in the usual manner.

Justice of the peace empowered to send any case to be tried by the quarter sessions.—Provided always, and be it enacted, that (if upon the hearing of any such complaint he shall think fit) it shall be lawful for such justice, instead of deciding upon the matter of complaint summarily, to commit the person or persons charged with such offence for trial for the same at the quarter sessions for the county or place wherein such offence shall have been committed, and to order that any such person so committed shall be imprisoned and detained in any of her Majesty's gaols or houses of correction in the said county or place in the mean time, or to take bail for his appearance, with or without sureties, in his discretion; and every such person so offending, and convicted before such court of quarter sessions as aforesaid (which said court is hereby required to take cognizance of and hear and determine such complaint), shall be liable, in the discretion of such court, to be imprisoned, with or without hard labour, for any term not exceeding two years.

Punishment of persons obstructing railway.—And be it enacted, that from and after the passing of this Act every person who shall wilfully do or cause to be done any thing in such manner as to obstruct any engine or carriage using any railway, or to endanger the safety of persons conveyed in or upon the same, or shall aid or assist therein, shall be guilty of a misdemeanor, and being convicted thereof shall be liable, at the discretion of the court before which he shall have been convicted, to be imprisoned, with or without hard labour, for any term not exceeding two years.

For punishment of persons obstructing the officers of railway company, or trespassing upon any railway.—And be it enacted, that if any person shall wilfully obstruct or impede any officer or agent of any railway company in the execution of his duty upon any railway, or upon or in any of the stations or other works or premises connected therewith, or if any person shall wilfully trespass upon any railway, or any of the stations or other works or premises connected therewith, and shall refuse to quit the same upon request to him made by any officer or agent of the said company, every such person so offending, and all others aiding or assisting therein, shall and may be seized and detained by any such officer or agent, or any person whom he may call to his assistance, until such offender or offenders can be conveniently taken before some justice of the peace for the county or place wherein such offence shall be committed, and when convicted before such justice as aforesaid (who is hereby authorized and required, upon complaint to him upon oath, to take cognizance, thereof, and to act summarily in the premises,) shall, in the discretion of such justice, forfeit to her Majesty any sum not exceeding 5*l*, and in default of payment thereof shall or may be imprisoned for any term not exceeding two calendar months, such imprisonment to be determined on payment of the amount of the penalty.

Proceedings not to be quashed for want of form, or removed into the superior courts.—And be it enacted, that no proceedings to be had and taken in pursuance of this Act shall be quashed or vacated for want of form, or be removed by certiorari, or by any other writ or process whatsoever, into any of her Majesty's courts of record at Westminster or elsewhere, any law or statute to the contrary notwithstanding.

Repeal of all provisions in railway Acts that empower two justices to decide disputes respecting the proper places for openings in the ledges or flanches of railways.—And whereas many railway companies are bound, by the provisions of the Acts of Parliament by which they are incorporated or regulated, to make, at the expence of the owner or occupier of lands adjoining the railway, openings in the ledges or flanches thereof (except at certain places on such railway in the said Acts specified), for effecting communications between such railway and any collateral or branch railway to be laid down over such lands, and any disagreement or difference which shall arise as to the proper places for making any such openings in the ledges or flanches is by such Acts directed to be referred to the decision of any two justices of the peace within their respective jurisdictions: and whereas it is expedient that so much of every clause, provision, and enactment in any Act of Parliament heretofore passed, as gives to any justice or justices the power of hearing or deciding upon any such disagreement or difference as to the proper places for any such openings in the ledges or flanches of any railway, should be repealed; be it therefore enacted, that so much of every such clause, provision, and enactment as aforesaid shall be repealed.

Board of Trade to determine such disputes in future.—And be it enacted, that in case any disagreement or difference shall arise between any such owner or occupier, or other persons, and any railway company, as to the proper places for any such openings in the ledges or flanches of any railway (except at such places as aforesaid), for the purpose of such communication, then the same shall be left to the decision of the lords of the said committee, who are hereby empowered to hear and determine the same in such way as they shall think fit, and their determination shall be binding on all parties.

Communications to the board to be left at their office.—Communications by the board how to be authenticated. What shall be deemed good service on railway company.—And be it enacted, that all notices, returns, and other documents required by this Act to be given to or laid before the lords of the said committee shall be delivered to or sent by the post to the office of the lords of the said committee; and all notices, appointments, requisitions, certificates, or other documents in writing, signed by one of the secretaries of the said committee, or by some officer appointed for that purpose by the lords of the said committee, and purporting to be made by the lords of the said committee, shall, for the purposes of this Act, be deemed to have been made by the lords of the said committee; and service of the same upon any one or more of the directors of any railway company, or on the secretary or clerk of the said company, or by leaving the same with the clerk or officer at one of the stations belonging to the said company, shall be deemed good service upon the said company.

Meaning of the words "railway" *and* "company."—And be it enacted, that wherever the word "railway" is used in this Act it shall be construed to extend to all railways constructed under the powers of any Act of Parliament, and intended for the conveyance of passengers in or upon carriages drawn or impelled by the power of steam or by any other mechanical power; and wherever the word "company" is used in this Act it shall be construed to extend to and include the proprietors for the time being of any such railway, whether a body corporate or individuals, and their lessees, executors, administrators, and assigns, unless the subject or context be repugnant to such construction.

Act may be repealed this session.—And be it enacted, that this Act may be amended or repealed by any Act to be passed in the present Session of Parliament.

THE THAMES EMBANKMENT.

ABRIDGEMENT OF THE EVIDENCE.

(Concluded from p. 360.)

Mr. *Stephen Leach* stated, that he is clerk of the works on the river Thames, from Staines to Yantlet Creek; 39 years in all he has been in the service of the corporation; nine years assistant to his predecessor, and 30 years since. Very considerable improvements have taken place under his direction in the navigation of the Thames between Putney and Staines; when he came into the office, the navigation there was in a very bad state; it was no unusual thing for 50 or 60 barges to be aground in one place, and some of them he has known to be a fortnight working through the city jurisdiction. At present they get up with tolerable certainty, from the Pool to Staines, in 16 or 18 hours, and down from that place in less time; those improvements have been made under his direction. The improvements consist of the building of six pound-locks and five weirs, in different places, where the impediments were the greatest; the removal of a number of shoals, and the raising of towing-paths with the ballast so removed. He has considered the plan now before the Committee for embanking the river Thames from Vauxhall Bridge to London Bridge, on the north side; he considers it certainly as calculated to effect an indispensable improvement, by a very obvious and usual mode of improving river navigation, namely, by contraction; it is much too wide in several places to preserve a uniform depth, and a convenient one for navigation. The object of this embankment would be to equalize the section of the river, to regulate the velocity, and thereby to displace and enclose the large quantities of mud which are at present on the shores, and which receive the noxious contents of the sewers. The embankment begins at Vauxhall Bridge, where there is a short length, not very important. With regard to the navigation that joins from Vauxhall Bridge to Millbank, opposite the Penitentiary, there the embankment is complete, which is carried out to the full extent; there is no intention in that part of carrying it further out; he considers it as a specimen of what the embankment would be if it were continued in a similar way. The line is taken to the Horseferry-road, Horseferry-stairs, in front of the Marquess of Westminster's property; that would be a very beneficial improvement in his opinion. No part of that is embanked at present; the proposition is, to come flush with a very old wharf, which has been there for many years, now in the possession of Mr. Johnson, a stone wharf, in a line with the embankment at the Parliament Houses, which completes it to Westminster Bridge; below Westminster Bridge the embankment is proposed to be continued to Scotland-yard; and there, on account of the particular nature of the business, and the number of coal barges, it is proposed to discontinue the embankment, and adopt a low embankment of some two or three feet above low water, so as to form a dock for the more convenient carrying and entering those barges; that is Mr. Walker's plan, and it is one in which he (Mr. Leach) quite concurs, according to the present occupation. From Scotland-yard, in front of the Hungerford Market estate, the York-buildings' estate, the Savoy, and so on, he thinks there is a length of about 1,400 feet, and an average width of about 300 feet; the mud on part of this ground is already so grown up as to have a pretty large vegetation upon it in front of York-buildings, already embanked with an accumulation of mud. From Waterloo Bridge the embankment is proposed to be continued in front of Somerset House and King's College, about 600 feet in length, and an average width of 130 feet; and at no place, in his opinion, is an embankment so much needed as in front of Somerset House, where there is a very lofty heavy pile of building immediately on the brink of the river, and he thinks it wants something to defend it in front of it, which would be a protection to the building; there is a depth of water in front of it, at the upper end of it particularly; the set of the current is immediately in that direction: that violent current has so deepened the water at Waterloo Bridge, that the late Sir Edward Banks recommended a deposit of about 3,000 tons of stone to protect the Bridge. From King's College the embankment proceeds about 460 feet in length, with an average width of about 190 feet to Water-street, from whence, the occupation of the wharfs being principally by coal merchants, the open-dock system of low wharfing is proposed; there must be an open dock there to accommodate the coal trade; then the embankment would be continued to the end of Temple Gardens; it is then intended to adopt the open-dock system and the low wharfing below the Temple, from Whitefriars-dock to Blackfriars Bridge. There is nothing particular between Blackfriars and Southwark Bridges, only to correct the present irregularities, and make a fair and straight line. It goes on to London Bridge; at the bridge it wants no contraction whatever, it is already quite small enough.

Mr. *James White Higgins* was examined; he is a surveyor of long standing; has been engaged both in the service of the Commissioners of Woods and Forests, and of the City of London, on very many occasions. The quantity of land to be embanked is 595,400 feet, that is, reclaimed by solid embankment; that I have from Mr. Walker's estimate, and that is independent of the Crown property. The amount of Crown property is 436,150 feet. With reference to value, it is an exceedingly difficult question to deal with, and one that does not often occur; and as practice and experience are the best test of value, he has felt a good deal of difficulty in dealing with it. He has made it a matter of inquiry, and having had a great deal to do with wharf property, perhaps more than most professional persons he has endeavoured to bring the experience he possesses and the information he could gain to bear upon the subject; the conviction of his mind is, that 2*d.* a superficial foot, which was talked of, the property could not bear; he thinks it would be excessive; but he thinks 1*d.* a foot superficial might be borne, which would yield nearly 2,500*l.* per annum upon the solid embankment; he thinks so, as he has already stated, from the experience he has, from the advantages it is calculated to afford. It involves the improvement of the navigation of the river, which the persons using the wharfs would be benefited by; it gives them an increased quantity of freehold property; and with regard to that freehold property, if, as was done in a former case, he believes, and that to some considerable extent, at the time of building Blackfriars Bridge, the freehold property was made also free from rates and taxes, it would afford another advantage. That property so reclaimed at Blackfriars Bridge was charged at 1*d.* a foot, he finds; as far as he has been able to learn, it was found to work well; and one advantage that would be afforded here is, that in some cases persons with bad wharf walls would get good ones. In other cases, the general property would be secured by this embankment, and a great public highway, the Thames, would be benefited, and persons using it. Persons possessing themselves of freehold land, he thinks, would have no just ground of complaint in paying 1*d.* a foot for the property reclaimed; but there would be this difficulty about it, and one which the honourable Committee will feel perhaps to be considerable, a penny a foot on some portion of the property would be much too little, and on others it would be too much; in some cases persons would get the more valuable part of the property in Thames-street; he knows that they would be very glad to pay 2*d.* a foot; but in other cases he knows persons would not be willing to pay a penny per foot. The honourable member for Lambeth has alluded to cases in which the advantages now possessed by individuals would be lessened. Those points all want consideration. Every individual case, to do what he is quite sure the Committee are desirous to do, viz. to do justice, would require a matter of consideration; that is an affair which he has not entered upon except in this way, he has judged from his own experience. He has valued a good deal of wharf property; he has lately had to buy a good deal for the Crown at the enormous price that was invariably asked; we were then told that a few feet were worth nobody knows what money. He has also had to value with reference to a good deal of the parish assessments along the river, Hungerford Market and other parts; now he is quite satisfied that in some cases it would be an extraordinary boon at a penny per foot; but in others 1*d.* per foot could not be borne. How the separate cases are to be met he must leave to the Committee; but, in going from wharf to wharf, (he does not mean the Committee to understand that he has been on every wharf, he has been on many), he has put down what each wharf would bear, and that comes nearly to 1*d.* per foot, so that he feels warranted in saying that 2,500*l.* a year might be charged for the whole line of embankment, from one extremity to the other, where a solid embankment exists; but it is a matter of considerable difficulty. He has endeavoured to do it as honestly and impartially as he could, and bring all the experience which he has to the subject. Then as regards the dwarf piling, that is 725,700 feet; the superficial quantity enclosed by the dwarf piling, a halfpenny per foot has been talked of for that; he has more difficulty in this than in the other case, in saying what is right. There are advantages with reference to the navigation and security of buildings, and the possession of freehold instead of what, so far as he has heard of the evidence, appears to be a doubtful property, the city claiming a right over it, which would be abandoned, he takes it, in this case. But he has not, as in the case of Blackfriars Bridge, any test here, and after thinking of it a good deal, he has taken an annual sum for it of 1,133*l.*, that is, between a halfpenny and a farthing, the intermediate sum, as an annual sum; a halfpenny per foot was mentioned; he thought it too much, for it gave larger rent in some places than it appeared to me they could bear, though they have advantages in this case; by becoming their own freehold they would have a right to embank at any future period; but it is a matter of so much difficulty, that to give his evidence as he could upon some subjects, to say that he knows from experience that the property would produce such results, he could not pretend to do. It is open to much doubt. His impression is, that in both cases he has been moderate; he intended to be so. It would be worth to sell, twenty-five years' purchase. He would not be warranted in putting it at 25 years' purchase unless it was connected with the other portions of the property. Freehold land connected with buildings is generally at 20 years' purchase only. A ground-rent, amply secured, has sold for 30 or 31 years' purchase. This is an intermediate case of 25 years' purchase. He thinks 30 years would be too much, as there is some speculation in it, or else it is a ground-rent, and therefore he thought 25 was safer.

The following is the Report of Mr. Walker made in 1821, referred to in his evidence given in the last month's Journal.

"From the recent, and, we believe, accurate surveys that have been made, it appears that the difference of level in the water above and below bridge, towards the latter end of the ebb of a spring tide, is from 4 feet 4 inches to 5 feet 7 inches; the water is therefore at present dammed up to that extent at the bridge; we find, by calculation, that this pen will be reduced from, say 5 feet, to about 3 inches, by the proposed alterations; and the water above bridge, at low water, will therefore be 4 feet 9 inches lower than at present. But as the velocity of the stream above bridge will be increased by a greater quantity of water having to run through in the same time, both on account of the water flowing higher at high water, and ebbing lower at low water, the inclination of the surface will also be increased; and this lowering of 4 feet 9 inches, above referred to, will decrease as the distance from the bridge increases. Now, by the survey above referred to, the present rise in the surface of the water from London Bridge to Westminster Bridge, at low water, is 12 inches, being 6 inches, per mile; and supposing the velocity, after the alterations, to be increased so as to produce twice the inclination, or 12 inches per mile, the surface of the water at Westminster Bridge will be lowered, at low water, 4 feet 9 inches, less one foot (the increase of fall), or 3 feet 9 inches below its present level at spring tides. Again, from the best information we can collect, the rise of surface from Westminster to Fulham is about 8 inches per mile; and as the effect of the alterations of London Bridge will be less sensibly felt here than nearer the bridge, we assume that the inclination, after the alterations, will be 12 inches per mile, and the distance being nearly 6 miles, the water at Fulham will be lowered at low water 3 feet 9 inches less 2 feet, or 1 foot 9 inches, which will increase as we descend towards Westminster Bridge, when (as before stated) the depression will be 3 feet 9 inches. Again, as at Fulham, the surface will be lowered 1 foot 9 inches, this depression will decrease upwards; but as in any given length upwards, the effect of the proposed alterations will also decrease, this depth (1 foot 9 inches) will be felt a considerable way up the river; for we think it probable that the effect of the alterations may be sensible, in point of the navigation, for 6 miles above Fulham Bridge, or at Kew Bridge; and that though it will really extend higher, we apprehend that its effects will not be of any consequence above that point. We believe there is no speculation in any of the above numbers, excepting in the assumed increase of declination of surface; for the correctness of which we cannot vouch, but we have been guided by the consideration that 4 feet 9 inches at low water, and about 9 inches at high water, making together 5 feet 6 inches, will be added to the depth of water which will pass through the bridge at every spring tide; and by allowing an increase of fall in proportion to the square of the increase of velocity or quantity, and also by referring to the inclination in the upper part of the river, say between Mortlake and Teddington, as shown upon Mr. Whitworth's survey, and making such allowance as from the difference of situation appeared to us reasonable, we apprehend that we are not far from being correct, particularly between Fulham and London Bridge; and it is hardly necessary, after the above, to say that we agree in opinion with Mr. Smeaton, that, by this reduction of fall at the bridge, 'the navigation of that part of the river will be materially affected.' It appears to us, from our own knowledge, and from the statements that have been given to us, that although the increased velocity of the river would have a tendency to restore the river to its ancient depth, and in course of time would probably effect that object, yet that so great a lowering at once would be productive of great temporary inconvenience, unless artificial means were resorted to, to deepen the shoals, which, even in the present state of the river, are attended with considerable hindrance to the navigation. Mr. Smeaton's opinion on this subject goes beyond our ideas of time; but, as great respect is due to his opinion, we extract it in his own words: 'If this difference of bed,' that is, the difference above and below bridge, 'is original, we must expect it to remain after the bridge is taken away; but if an effect, the cause being removed, the river would gradually restore itself; but as this might probably take up 700 or 800 years (the time it has probably been gathering), the work of restitution would go on far too slowly to answer the demands of the present generation.' Our opinion is, that the difference of level in the bottom of the river, above and below bridge, is caused, in a great measure, by the pen of the bridge; and although we think that the work of restitution would be complete in less time than stated by Mr. Smeaton, unless where the accumulation has got cemented into a solid mass, which we have no doubt is in many places the case, yet, both for the purposes of present trade, and to prevent the shoals from being moved down the river by the current, and forming obstructions lower down the river or below bridge, we think that ballasting to a great extent will be expedient and requisite; as, in addition to the above reason, the stuff that is excavated from the upper part may be applied to raise the towing-paths and banks, so as to meet the increased height of the high water, which will occasionally be from 1 to 2 feet above the present level. One principal shoal is close above London Bridge, on the Surrey side; it extends almost half-way across the river, and is even now occasionally above low water. This must therefore be deepened to a considerable extent; and to prevent the opening of any of the proposed widened arches, which will be opposite to it, from washing any part of it into the Pool, and settling upon the shoals below bridge, it, as well as the other shoals, ought to be ballasted away before the proposed arches are opened. In regard to the navigation through London Bridge, we are of opinion that it will be very essentially improved by the proposed alterations, and that the cause of the losses, accidents, and dangers to which the passage is at present subject, from the great fall or shoot in the arches, will be almost entirely removed. We have mentioned, that the velocity of the current above bridge will be increased. This will take place during both the flood and ebb tide, but will be greatest in the latter; and the increase of velocity will, as before stated, be greatest between Westminster and London Bridges. In our calculation of the fall, we have supposed that the increase of velocity will amount to one-half of the present velocity. This will, in many cases, be important, not only as regards the velocity itself, (as to which it will sometimes be found of advantage to craft and sometimes probably otherwise), but as the water will ebb sooner from all the wharfs, the time in each tide during which the barges are afloat at the wharfs and when they can float to and from them, will be decreased. This will, so far, be a disadvantage, but will occur only during the ebb of tide. It is evident, however, that it will not be compensated by the increased velocity of the flood-tide bringing the barges sooner to the wharfs above bridge, as the velocity of the flood will not be so much increased as that of the ebb-tide, and although barges may come up opposite to the wharfs sooner in the tide than they do at present, if the channel is deep enough, they will not be able to get close to the wharfs until about the same time of tide they do at present, unless a general artificial deepening takes place opposite to each wharf. In some cases, however, barges which may get opposite to the wharfs early in the tide, will be enabled by having done so to draw in to the wharfs so soon as there is depth enough of water to float them in, and, so far as this goes, the effect of this proposed alteration will be useful. The great cause of shoals is the unequal velocity of currents, and this inequality increases as the velocity increases; for therefore it is that floods, or great velocities, are always found to add to the shoals of navigable rivers, and to deepen what was too deep before. The increased current through the narrow parts disturbs and carries down the materials of the bottom through those narrow parts or deeps, and they are lodged upon the shoals below, where the decreased velocity, caused by the widening of the river, has not force enough to carry them along with it. There can be no more striking illustration of this general theory, than the effect of floods upon the river near London Bridge, which is invariably to deepen between the arches, and at the same time to raise the shoals below the bridge; therefore, although the natural effect of the increase of current is upon the whole to deepen its channel, it does it so partially that it has also the effect, in rivers of unequal current, such as the Thames is, of forming and increasing shoals, and unless guarded against by proper means may therefore be injurious to the navigation. Now the effect of opening London Bridge will be, that the ebb-tide and land-floods, not being checked by the pen of London Bridge, will increase in velocity to the extent *up the river* that the effects of this pen are felt, and produce the consequences we have mentioned, so that an increase of expense in deepening the shoals after floods, and a greater inequality of level in the bottom, will be the consequence, and this will be a lasting expense unless means are taken to prevent it. The means we should recommend are, the nearer approximation to an *uniform velocity*, which would best be accomplished by producing an *equality of area*, such as contracting the *width* of the river abreast of the shoals, *by means of embankments or otherwise*: as this cannot, however, be done in many places to the required extent without enormous expense, ballasting must be had recourse to until a new regimen corresponding to the existing circumstances is obtained. Finally, although we think it might have been desirable that the great change, which the proposed opening of the arches in London Bridge will certainly produce in the navigation, had been made, so that their effects might have been felt, and things conformed to the new state by degrees, yet when called upon to give an opinion without these experiments, we feel little hesitation in saying that if effectual means are taken for preventing the evils to which we have referred, then the proposed alterations will be beneficial to the navigation above bridge, but that without those effectual means they will be injurious."

Now, the fact is, that the alterations have been made to the full extent stated in this report, and the consequences have been to the full extent of what is stated, but as yet no means have been taken to remove the evil which was anticipated, and is now felt.

A Statement showing the Sectional Areas of the River Thames, taken in the Years 1823 and 1831.

—	No. 7. Sections.	Sectional Area of the Tidal Water below Trinity High-water Mark.		Difference in 1831.	Sectional Area below Low-water Mark.		Difference in 1831.	Total Sectional Area of the River Thames below Trinity High-water Mark.		Difference in 1831.
		By Survey of 1823.	By Survey of 1831.		By Survey of 1823.	By Survey of 1831.		By Survey of 1823.	By Survey of 1831.	
		Sup. Feet.	*Sup. Feet.*		*Sup. Feet.*	*Sup. Feet.*		*Sup. Feet.*	*Sup. Feet.*	
About 230 yards north of Westminster Bridge . . .	4	15,409	16,559	increase 1,150	3,939	3,487	decrease 452	19,348	20,046	increase 698
Near King's Arms Stairs and Whitehall Stairs	5	16,411	17,090	ditto 679	4,757	6,570	increase 1,813	21,168	23,660	ditto 2,492
Near Hungerford Stairs . .	6	16,083	17,902	ditto 1,819	3,891	3,920	ditto 29	19,974	21,822	ditto 1,848
Near Waterloo Bridge . . .	8	16,818	16,958	ditto 140	3,752	3,947	ditto 195	20,570	20,905	ditto 335
Opposite Bouverie Street . .	11	13,959	14,310	ditto 351	4,332	3,900	decrease 432	18,291	18,210	decrease 81
Between Blackfriars and Southwark Bridge	13	12,982	13,822	ditto 840	3,976	3,381	ditto 595	16,958	17,203	increase 245

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 14.—The President in the Chair.

"*Description of a Dynamometer, or an Instrument for measuring the Friction on Roads, Railways, Canals, &c.*" By Henry Carr, Grad. Inst. C.E.

The object of Mr. Carr's modification of the dynamometer is to obviate the irregularity of the common indicator arm, caused by the jerking motion of the tractive power or any inequality of resistance. The instrument consists of a cylinder half filled with mercury, and containing a piston connected with the spring of the dynamometer, so as to be lowered or raised as the tractive power is increased or diminished. Two tubes of glass, connected by a passage with a regulating valve, stand in front of the cylinder, one of them communicating freely with it, and in this tube the mercury is raised or lowered proportionally to the power applied; while in the other, an average of the variations is obtained as the facility of communication between the tubes is increased or diminished by the opening or closing of the stop-valve. The instrument must be graduated by actual experiment, and the results of the average power may be read off from the scales placed behind the tubes. The paper is illustrated by a detailed drawing of the machine.

"*An account of a proposed Suspension Bridge over the Haslar Lake at Portsmouth.*" By Andrew Burn, Jun., Grad. Inst. C. E.

The usual calculation for the maximum load on each superficial foot of the platforms of suspension bridges is 70 lb.; but, as in the event of a crowd of persons assembling the pressure may increase to nearly 100 lb. per foot, and by the passage of soldiers marching in regular time the strain may be greatly augmented, the projector assumed 200 lb. per superficial foot as the amount of load to which the platform might be subjected. The peculiar feature of this bridge is the substitution of cast-iron chains for the wrought-iron ones generally used. This deviation from the usual practice is adopted as a measure of economy, and with a view of increasing their stability and durability, cast-iron being much less influenced by atmospheric action than wrought-iron. Cast-iron beams, when well proportioned, will bear a very considerable tensile strain. As these chains would be proved beyond the weight they are intended to bear, no doubt is entertained by the author of their security. The platform, which is formed of transverse iron girders carrying cast-iron plates $\frac{3}{4}$ of an inch thick, with dovetails falling into holes cast in the girders, is suspended by wrought-iron rods $1\frac{1}{2}$ inch square from two lines of chain only, as the strain is more easily brought to bear on them than on a greater number of chains. They are trussed laterally to prevent oscillation, and the balustrade is so constructed as to prevent the undulation so prejudicial to suspension bridges generally. To insure a perfect bearing, each pair of links of the chains are in manufacturing cramped together, and the holes bored out to receive the pins which are turned to fit them accurately; they are of a larger size than usual, being 4 inches diameter, and a less number are employed. The piers on which the chains pass are of cast-iron, 33 feet high above the level of the roadway.

	Feet.
The extreme length of the bridge is	632
The breadth of the roadway	$17\frac{1}{2}$
The clear waterway between the piers . . .	300
The clear headway of the platform above the high water line	$18\frac{1}{2}$
Ditto ditto above low water line . .	33

The tension on the chains is calculated as equal to 991·4143 tons. To sustain this tension, the section of the chains is 256 square inches, and taking 7 tons per square inch as the elastic limit of cast-iron, the resistance of the chains will equal 1792 tons, leaving a surplus of 800·6 tons after the calculated strain has been deducted from the real strength of the chains. Three elaborate detailed drawings accompany this paper.

Mr. Smith, of Deenston, *explained a new system of Lockage for Canals proposed by him, a model of which he presented to the Institution.*

To avoid the present expensive construction of locks and their waste of water, the author proposes to divide the canal into a series of basins, the water levels of which should be from 12 to 18 inches above each other. The extremity of each basin is so contracted as to permit only the free passage of a boat; in this is placed a single gate, hinged to a sill across the bottom, the head pointing at a given angle against the stream, and the lateral faces pressing against rabbets in the masonry. The gate is to be constructed of buoyant materials, or made hollow so as to float and be held up by the pressure of the water in the higher level; on the top is a roller to facilitate the passage of the boats. When a boat is required to pass from a higher to a lower level, the bow end, which must be armed with an inclined projection, depresses the gate as much as the depth of the immersion of the boat, and as much water escapes as can pass between its sides and the walls of the contracted part of the basin. The same action takes place in ascending, except that a certain amount of power must be expended to enable the boat to surmount the difference of level between the basins. The quantity of water wasted by each boat would be in proportion to its immersion and the speed at which it passed over the gate. In case of different sized boats passing along the same canal, it is proposed to have a small gate forming part of the main gate, so as to avoid the loss of water which would ensue from the whole width being open for the passage of a small boat.

This system has only been tried by models; but it is proposed to make an essay on an extensive canal next summer, when the results will be communicated to the Institution.

May 5.—The PRESIDENT in the Chair.

The following were balloted for and elected:—Angier March Perkins, St. George Burke, and Beriah Botfield, as Associates.

"*Description of the Engines on board the Iron Steam Tug, the Alice.*" By J. Patrick, Inst. C. E.

The speed of this boat having far exceeded the constructor's expectations, induced the author to send a description of her proportions, and of the construction of the engines. The chief peculiarity in the engines is their being placed in the centre of the vessel, with the two cylinders in a line with the keel, and placed at an angle of 45°, inclining inwards towards the paddle shaft, to which the motion is communicated direct (without the use of side beams) by long connecting rods attached to the cross heads, which are placed at the lower ends of the cylinders, instead of being on the top as in the usual manner; the connecting rods are thus enabled to be three times instead of twice the length of the stroke, as is usually the case. The framing is entirely of wrought-iron on the tension principle, and appears to resist the tendency to vibration better than cast-iron framing. For the two cylinders of 31 inches diameter, there is only one air pump of 22½ inches diameter, with 19½ inches length of stroke, instead of the usual complement of two air pumps, 18 inches diameter each; this is found to be sufficient, as a vacuum of 13¾ lb. per square inch is maintained. One of the advantages proposed by this mode of construction is the reduction of weight; these engines only weighing 9 cwt. per horse power. The small space occupied leaving more room for passengers, they are particularly adapted for river navigation, where the breadth of beam must be limited. The simplicity of their construction renders them less liable to expensive repairs.

The principal proportions of the Alice are—

	Feet.	Inches.
Length between perpendiculars . . .	95	
Breadth of beam	20	
Draft of water	4	6
Diameter of wheel	14	
Size of engines	two 30 horse power	
Diameter of cylinder	0	31 inches
Length of stroke	3	3

The engines were constructed by Messrs. Davenport and Grindrod, of Liverpool. Drawings of the boat and engines accompany this communication.

"*Description of an Apparatus for preventing the Explosion of Steam Boilers.*" By Robert M'Ewen.

The frequent explosions of steam boilers, caused in many instances by the steam being confined until it acquires a density greater than the boiler can resist, induced the author to invent a simple, self-acting apparatus, intended to warn the engineer whenever the pressure exceeded the proper degree of safety.

The apparatus under consideration is constructed on the principle that steam, in proportion to its density, will support a column of water or mercury, of a given height, and that any fluid will find the same level in two or more vessels, provided there be a free communication between them. It may be called a mercurial safety valve, and consists of a cylinder, within which are two cups, with two pipes dipping into them of a length proportioned to the pressure of the steam; these pipes are connected at the top with two valves on one spindle, so arranged, as that when one is open the other must be closed. On the top is a waste steam pipe open to the atmosphere. One pipe being filled with mercury, and the valve connected with it being open, the mercury remains stationary until the pressure of the steam exceeds its proper point. It will then be blown out and fall into the empty cup, allowing the steam to escape by the waste pipe, and giving warning to the engineer by its noise. When the pressure is again reduced to its proper point the valve is reversed, and the mercury will, on the next occasion of an increase of pressure, be blown back again, still giving warning on either side.

Plans and sections of this apparatus accompanied the paper.

"*On setting out Railway Curves.*" By Charles Bourns, Assoc. Inst. C. E.

Mr. Bourns having been engaged in setting out the Taff Vale Railway through a country presenting circumstances of more than ordinary difficulty, which rendered it necessary to vary the radii and the flexure of the curves frequently, his attention was particularly directed to the subject; and he has treated it in this paper clearly and successfully, demonstrating the several cases geometrically, and generally in a plain and satisfactory manner. He calls attention to the inaccuracy of applying a square to the setting out of segmental curves, particularly those of short radii, and recommends an offset staff as theoretically correct and practically much more convenient. The general rule to find the offset is—"Divide the number of inches in the chain used by the number of such chains in the radius of the required curve, the quotient is the offset in inches." The paper is accompanied by a table of offsets for curves of different radii; which the author found extremely convenient for use in the field.

The paper being altogether mathematical is not adapted for publication in abstract; but it will be given at length, with examples and diagrams, in the Transactions of the Institution.

"*Description of an Instrument for describing the Profile of Roads.*" By Henry Carr, Grad. Inst. C. E.

The object of the author was the construction of a machine, which, being drawn along any road of moderately even surface, should describe the section of the line over which it passed. It is evident, that if a pendulum be suspended from a frame standing perpendicularly when the machine rests on a horizontal plane, on passing over a plane inclined at any angle with the horizon, the pendulum must form the same angle with the frame the tangent of which angle in terms of the radius will be the rise or fall of the plane. The duration of the tangent will be determined by the paper on which the section is drawn being made to traverse at a speed proportionate to the distance passed over; and the extent, by the difference of the speeds of a nut and screw which are made to revolve in the same direction—the nut turning at a constant velocity, and the screw at a speed differing from that of the nut in proportion to the tangent, slower or faster as the tangent is *plus* or *minus*, raising or lowering the nut according to the deviation of the plane from the horizontal line.

The machinery is set in motion by the wheels of the carriage, and a series of wheels and pinions of given diameters cause the ground line and datum line to be drawn simultaneously by two pencils on a paper which gradually unfolds itself from one drum, and is transfered to another at the rate of 16 inches per mile passed over, or on a scale of 5 chains to the inch. A profile of a line of country may thus be obtained with sufficient accuracy for a preliminary survey.

A comprehensive perspective drawing accompanies the paper, and explains the construction of the machine.

May 12.—The PRESIDENT in the Chair.

"*Photography, as applicable to Engineering.*" By Alexander Gordon, M. Inst. C. E.

The object of the author in this paper is to direct general attention to the advantages which may be expected to result to the profession of the Civil Engineer from the discoveries of Mons. Daguerre and others, in enabling copies of drawings, or views of buildings, works, or even of machinery when not in motion, to be taken with perfect accuracy in a very short space of time and with comparatively small expense. This system of copying not only the outline, but the tints of light and shade, united with accurate linear perspective, he contends may be easily adapted to the purpose of the engineer, as well as to all those professions in which the art of drawing is used. The photographic apparatus has already been employed to bring before us exact copies of the most interesting monuments of antiquity, the French antiquarians and artists having found it more easy and correct to Daguerreotype the Egyptian monuments and decipher the hieroglyphics at their leisure, than to labour over the originals.

The subject is divided into two branches: the first being the art of copying drawings and plans by the transmission and absorption of light by prepared paper. The drawing to be copied is placed between two pieces of plate glass, held down in close contact with a sheet of photogenic paper, prepared by being washed over on both sides with a neutral solution of nitrate of silver of a spectfic gravity of 1·066, and afterwards with a solution of common salt and water (1lb. of salt to 25 pints of water). The paper thus prepared must be dried and kept in the dark, on account of its peculiar delicacy. The rays of the sun are then permitted to pass through the white portions of the drawing or print, while they are interrupted by the black lines, and more or less by the tinted portions. The rays of light thus act upon the prepared paper, and produce, in a few minutes, a reversed copy, reproducing the lights of the original in shadows; this can be remedied by taking a second copy from the first, and thus the shadows are restored to their original positions. To destroy the sensitiveness of the prepared paper, and preserve the copy, it is soaked in pure water, which carries off the excess of nitrate of silver, then covered with a solution of hypo-sulphite of soda of a specific gravity of 1,055, and again washed in pure water, so that when dried it is permanently fixed. It is evident that a copy thus obtained must be exactly like the original, and the value of such a process may be readily estimated by engineers.

The second branch, which is named "Daguerreotype," after the distinguished artist who brought it to its present state of perfection, is of a much higher order. This is the art of fixing and preserving on the surface of a polished silvered plate the images collected in the focal plane of a camera obscura.

The process is rather complicated, but may be thus briefly described. The surface of the silvered plate being cleaned and polished very perfectly by means of finely levigated pumice stone, olive oil, and cotton, is rubbed lightly over with diluted nitric acid, in the proportion of 1 pint of acid to

16 pints of distilled water; it is then subjected to the heat of charcoal or a spirit lamp until a firm white coating is formed all over the surface of the silver. The plate is then suddenly cooled. This process is repeated three times. It is placed in a dark chamber with the face or silver surface downwards, where it is acted upon by the spontaneous evaporation of iodine; this condenses upon the silver, and produces a fine gold-coloured surface, extremely sensitive to the impressions of light. It is then placed in a camera obscura, the light having been until then perfectly excluded from it. It there receives the impression of any images brought within the focal plane; and by subsequently exposing it in a dark, close chamber, with its silver surface downwards, to the fumes of heated mercury, the images are rendered visible; to fix the images so received, the iodine is removed by dipping the plate in pure water, and then washing it either with a weak solution of hypo-sulphite of soda or a saturated solution of common salt, and finally dipping it in distilled water and drying it. It should then be framed and glazed to preserve it from external injury, and the picture will remain unchanged.

Attempts have been made to use this process for preparing the plates for engravers, as much time and cost would thereby be saved, but hitherto it has not been done to any extent.

The author presses upon the Institution the applicability of these processes to engineering uses, and quotes the remark of Mons. Arago—"That photographic delineations having been subjected during their formation to the rules of geometry, we may be enabled, by the aid of a few simple data, to ascertain the exact dimensions of the most elevated parts of the most inaccessible edifices."

Mr. Cooper, Senior, introduced the subject of photography by explaining, and illustrating by instruments and diagrams, the principles of the division and dispersion of the rays of light, according to the Newtonian theory, as well as the most recent researches into the subject. He described the chemical properties of light—its affinity for certain combinations, such as chloride of silver—its heating powers—the different effects of the rays on vegetation—and the application of these known principles to photography. He then explained the chemical properties of the chloride of silver, iodine, and other substances used in the process. In alluding to the probable uses of the Daguerreotype, he observed that the process might be employed to make drawings of machinery, as graduated scales might be fixed to certain parts of the objects, and they would be copied in their relative proportions to the machine.

Mr. Cooper, Junior, illustrated Mr. Gordon's communication by explaining the photographic apparatus, and the process of obtaining a specimen of Daguerreotype by means of the oxy-hydrogen light. He described, among other points, the difficulty of obtaining pure silver upon the copper plates, as, for the advantage in rolling, the manufacturer will introduce an alloy of ½ to 1¼ per cent. On this account, acid is used so repeatedly in cleaning the plates, that any particles of copper which have been rolled into the surface may be carried off. He explained his improvement to the iodine box, which consists in spreading the iodine all over the bottom of a tray lined with glass, and covering it with a piece of card-board, which becomes saturated with the fumes of the iodine, and on the silvered plate being placed over it, acts equally over its surface, instead of partially, as in the old system of placing the iodine in a mass in the centre of the tray. He had found this to be a great improvement. The shortest time in which he had obtained a photographic picture in England was 11 minutes; while, during a gloomy day in November, it took an hour and a half to procure a moderately good one.

"*An Universal Screw-Jack.*" By George England.

This machine, a model of which was presented to the Institution, is intended for raising heavy weights and moving them in any required direction; the vertical motion is similar to that of a common screw-lifting jack, and the lateral motion is communicated by a ratchet lever to a horizontal screw, working in bearings on a strong cast-iron bed with planed surfaces through a double nut attached to the base of the jack. The jack has been found useful for erecting heavy pieces of machinery, and for replacing railway carriages and locomotives on the rails when they have been accidentally thrown off.

"*Description of a Traversing Screw-Jack.*" By W. J. Curtis.

The screw-jack is attached to a plank with a rack in it, and slides in a groove in another plank which is placed beneath it, across the railway; in the lower plank is a rack, by means of which and a hooked lever, the jack, with the engine or any other weight resting upon it, is drawn easily across the rails and lowered to its proper position. By this apparatus, engines and carriages of considerable weight have been replaced on a railway by two men in a very short space of time.

A model of the machine was presented to the Institution.

May 19.—The President in the Chair.

Peter Bruff was balloted for and elected an Associate.

"*Description of a new Gas Regulator.*" By James Milne.

The object of this instrument (which the inventor exhibited in action, and presented to the Institution) is to regulate the supply of gas to burners, so that any variation in the pressure, arising from extinguishing the adjacent lights along the line of the street main, or in the different floors of manufactories, shall not affect those lights which are supplied through the regulator.

The regulator consists of a cylindrical outer case, to which is affixed a water gauge to show the pressure; to the top is attached an inner cylinder, open at the lower end and reaching nearly to the bottom of the outer case; the gas is introduced from beneath by a tube in the centre, terminating in a conical valve at the top; the male part of the valve is fixed by three arms to the top of a float, which moves freely in the space between the inner cylinder and the centre tube; the areas between the outer case and the inner cylinder, and between the inner cylinder and the centre tube, being alike, the pressure of the gas acts upon the water within the inner cylinder, and causes it to rise in the outer case just as much as it is depressed in the inner space. This depression carries down the float with the male part of the valve attached to it, and thus diminishes the aperture of the supply pipe, until the pressure is relieved by other burners being lighted, and enables the supply of gas to be in proportion to the demand. The pressure may be regulated at will by increasing or diminishing the quantity of water in the cylinders, and it is shown correctly by the graduated glass gauge. This apparatus has been found, in an experience of two years, to effect a saving of about 20 per cent., independent of its ensuring a perfect equality to all the burners in action. Drawings of the instrument accompanied this communication.

Mr Lowe believed the "gas regulator" to be an efficient instrument. It was of the utmost importance that the light from gas should be steady and equal, as the nerves of the eye were more injured by an unsteady than by an intense light. In large establishments, the greatest care would scarcely prevent constant variation in the lights, so that an efficient means of producing regularity must be valuable.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Tenth Meeting.—*September*, 1840.

(From the Athenæum.)

Section G.—Mechanical Science.

Mr. Dircks gave an account of *a railway wheel with wood tyre*, which was exhibited in the museum. It was one of a set which had been in use for two months, carrying five tons each day. The construction of the wheel will be understood by imagining an ordinary spoked wheel, but with a deep-*channelled* tyre. In this channel is inserted blocks of African oak, measuring about 4 × 3½ inches, prepared by filling the pores with such unctious preparations as counteract the effects of capillary attraction in regard to wet or damp. The blocks are cut so as to fit very exactly, with the grain placed vertically throughout, forming a kind of wooden tyre. There are about thirty blocks of wood round each wheel, where they are retained in their places by bolts, the two sides of the channel having corresponding holes drilled through them for this purpose; each block of wood is thus fastened by one or two bolts, which are afterwards well rivetted. After being so fitted, the wheel is put into a lathe, and turned in the ordinary manner of turning iron tyres, when it acquires all the appearance of a common railway wheel, but with an outer wooden rim, and the flange only of iron. Mr. Dircks proposes the use of either hard or soft woods, and of various chemical preparations to prevent the admission of water into the pores of the wood: he also contemplates the using of wood well compressed.

Mr. Jeffrey *on a New Hydraulic Apparatus.*—It comprised an improvement on the ancient endless chain of buckets, which he considers of Egyptian origin. This apparatus has hitherto never acquired the value it admits of, on account of a defect having remained in its construction, opposed to geometrical principle—the buckets which bring up the water being fixed outside instead of within the rope. The effect of this is such an acceleration of the bucket, when it is carried round the wheel at top, as causes it to overtake the water and carry much of it down again. But, by placing the buckets on the centre side of the ropes, that is, within them, the bucket when passing round the wheel, being very near the centre, is much retarded, and the momentum of the water causes it to ride out of the bucket very effectually into the trough. A peculiarity in the form of the bucket also prevents the spilling of the water in cases where the motion is very slow.

Sir J. Robison stated that, although the methods in India are rude, yet they give a greater return of work done for power applied than other methods known.—Mr. Jeffrey stated that he had tried this method on a large scale, each bucket containing 1½ cwt. of water. A small valve at the bottom of the bucket allows the air to enter, and the bucket is thus quickly emptied.

"*Additional Notice concerning the most economical and effective proportion of Engine Power to the tonnage of the hull in Steam Vessels, and more especially in those designed for long voyages.*" By Mr. Scott Russell

Large power or small power? has always been a disputed question. The early steam boat engines had but a small power proportioned to the tonnage. The *Comet* had 25 tons burden, and only three horses power—being a proportion of power to tonnage amounting to ⅛. On this subject modern practice and opinion seem to offer no guide. The East India Company have used low proportions of power to tonnage, and in this they appear to have adopted the general maxims of Southern engineers. The Government appear also to have followed the same course, but without going to the same extreme. The Clyde engineers adopt the opposite maxim, and place as much power in their vessels as can be conveniently applied. There appears at present to be a feeling in favour of a high proportion of power to tonnage. It has been found by some of the best mercantile companies that a high proportion of power to tonnage is not only better for expedition, but also more economical of fuel and of capital; and instances are frequent of an increase in the power of a steam vessel, producing a diminution in the consumption of fuel. As this question is becoming every day of greater importance, it is proper to examine it carefully. In the first place, it is known that the proportion of power must be very much increased to gain a given increase of speed;—thus, if ten horses power propel a vessel through water five mile an hours, it will require forty horses power to propel the same vessel ten miles an hour; since it will require a quadruple power to obtain a double speed, in like manner it will require a ninefold power to triple the speed. A large power of engine, it may be said, occupies much useful space which might be filled with cargo. It consumes much coal, and the speed is by no means proportioned to the expense of fuel and machinery. But this is a limited view of the subject. If time, as an element, and a very important one in the value of mercantile conveyance, be calculated, then it will be found that in many cases the effects of high speed, at any expense of fuel, will compensate for that expense. But it is not on the value of speed at the present day that we proceed in this inquiry. We are to ascertain what may be the best proportion of power to tonnage in sea-going vessels. We have seen that the lowest speed is the most economical, and that it requires expensive additions to give high velocities. But in arriving at this conclusion, we have taken only the case of smooth water: here it is obvious that the smallest power will be most economical. But it should be remembered that the great purposes of steam are generally of a different nature from the mere generation of motion through a quiescent fluid. The force of adverse winds, waves, and tides are to be overcome,—and it is the success of steam in obtaining regularity and speed, in spite of these, which constitutes its superiority. Now, if we take a simple case of one of these, we shall soon find that a higher proportion of power to tonnage may be essential not only to speed but even to economy. Suppose, a steam-boat with a small proportion of power, capable of propelling the vessel at the velocity of three miles an hour through still water, to be applied to stem a current of three miles an hour, or a proportionately strong breeze,—is it not plain that the vessel would make no headway? This extreme case of too little power shows that there is at least one proportion of power which is too small for economy of fuel. We may now proceed to investigate the question of best proportion, or the point where the attainment of high speed is accompanied by absolute saving of fuel, as compared to lower velocity. For this purpose we merely take it for granted, that the speed through the water will be nearly as the square root of the former, according to the general law of the resistance of fluids; that the resistance offered by adverse winds, &c. has been ascertained, and is determined on a particular station, that is, that it is known that on a given station, a given vessel, with a given power, makes a voyage in adverse circumstances in, suppose, double the time of her most prosperous voyage, say her prosperous voyage in fourteen, and her adverse voyage in twenty-four days, being a retarding power of ten days out of twenty-four; we take this retardation of ten days as the measure of the retarding power of adverse weather in the given circumstances. By working out the result, we obtain the very simple rule for finding the best proportion of power to tonnage: from the square of the velocity of any given vessel in good weather, subtract the square of the velocity of the same vessel in the worst weather, divide the difference by the square of the velocity in good weather, and the quotient multiplied into double the horses' power of the said vessel, will give the power which would propel the same vessel in the same circumstances, with the smallest quantity of fuel. It further appears, that the consumption of fuel in the worst voyage, will not exceed that of the best voyage, in a greater proportion than 10 to 7—that is to say, for 70 tons of fuel burnt on a good voyage, it will not be necessary to carry more than 100 tons, in order to provide against the worst. Let us take, as example, a Transatlantic steam-ship, which has a proportion of 1 horse power to 4 tons of capacity; her unfavourable voyage being, between England and America, twenty-two days, and her favourable voyage fourteen days, being a comparative velocity 7 and 11.

$$\text{Then } h' = 2\,h'\,\frac{v^2 - v'^2}{v^2} = 2.\ \frac{121 - 49}{121} = 2\ \frac{72}{121} = \frac{12}{10} \text{ nearly.}$$

Hence the power should be increased in the ratio of 6 to 5—that is to say, the engines at present capable of exerting a power of 500 horses should have been capable of exerting a power of 600 horses, and would, in this case, consume less fuel, as well as produce greater regularity. The following result also follows:—The vessel of less power burns 30 tons per day, performs the distance in fourteen days, consuming 420 tons of coal in fair weather. The vessel of less power burns 30 tons, performs the distance in twenty-two days, consuming 660 tons in foul weather. The vessel of greater power burns 36 tons, performs the distance in twelve and a half days, consuming 468 tons in fair weather. The vessel of greater power burns 36 tons, performs the distance in 17·5 days, consuming 630 tons in foul weather; being a consumption of 64 tons less fuel, and performing the journey in four and a half days less than the other. It is manifest, that the store of fuel carried in the vessel with less power, must, on all occasions, be equal to the greatest consumption, that is to say, at least 660 tons, whereas 630 tons will be sufficient for the vessel of greater power, and, as in all vessels for long voyages, coals carried are much more costly than the mere price of coals, or as the freight of the vessel is more costly than the fuel, coals carried are to be reckoned at least as expensive as coals burnt. Moreover, as the gain in time is 4½ out of 22, being 20 per cent., it is plain that the vessel may be calculated to do the distance oftener in a year, because, as the times of starting must be regulated not by the shorter, but by the longest period of a voyage, seventeen and a half days in the one case, stand in the place of twenty-two in the other. It appears, therefore, that, for long voyages especially, there are great advantages in point of economy, certainty, and speed to be obtained by the use of vessels of a higher power than usual; and that in a given case, the best proportion of power to tonnage may readily be determined from the rules already laid down. In regard to absolute or definite proportion, it may be stated, as the result of the best vessels, that the proportion of power to tonnage should not be greater than one horse power to two tons, nor less than one horse to three tons; the greater proportion holding in the smaller, and the less proportion of power in the greater vessel.

Mr. Fairbairn agreed, that the horse power should be increased, but that in bad weather the consumption of fuel was not so great as in fine weather.—Mr. Russell said, that practically in good weather the engines are worked expansively. There are two systems. The south engineers are afraid of using full powers; they use smaller proportions of power to tonnage, and slack the power in head winds. The north engineers always set head to wind in bad weather, and work full power; and in good weather work expansively. In steamers worked on the south system, the advantages would be as Mr. Fairbairn stated; in steamers worked on the north system, the advantages would be as he stated.—Mr. Fairbairn was of opinion, that three tons to one horse power were better than four to one.—Mr. Russell said, that it was safe to give more power than the rule gives; that on the introduction of longer and sharper vessels less power would be required.—Mr. Fairbairn observed, that the goverment post-office steamers, in the Mediterranean, were so bad, that the French vessels constantly pass them.

Mr. Smith made some observations "*On the Drainage of Railway Embankments and Slopes.*"—Mr. Vignoles observed, that had Mr. Smith had as much experience on railways and their construction as himself, he would have known that all he had recommended had been done on various occasions, whenever the expense could be justified.

Mr. Mallet "*On the Action of Air and Water on Iron.*"—Mr. Mallet stated, generally, the nature of the principal practical results obtained by him, with respect to the durability and modes of protecting cast iron, wrought iron, or steel, under various conditions, when exposed to the corroding or chemical action of air and water, whether fresh or salt. These researches have been made under the sanction of the Association, and are still in progress. Numerical results have already been obtained of the absolute and relative durabilities of about 100 different varieties or makes of cast iron and of wrought iron, in each of the following conditions as to water,—viz. In clear sea or ocean water; in foul sea water, as in the harbours of large cities; in clear river water; in foul river water; in sea water at high temperatures; in sea water at various depths; in sea water of variable saltness. The results in all these cases are given in voluminous tables, so arranged as to enable the engineer to predict with confidence the durability of a given scantling of iron of a given sort, under given circumstances. The conditions of corrosion of iron, in contact with copper, with zinc, and with tin, and with various atomic alloys of these, have been determined, and printed tables of the results distributed to the Section. Results are also given as to the relative protecting power of several paints or varnishes, to the surface of iron exposed as above. The specific gravities of all the irons experimented on, have been taken by a new method, and the increment of specific gravity due to increased depth (or head of metal) in castings determined, and also the decrement of specific gravity due to increased bulk or scantling of castings determined. These are necessary data to the foregoing investigation, and are in themselves of importance to the engineer, with reference to the ultimate cohesion of cast iron, which seems to be related, and probably is some function of the specific gravity in any given case. The experiments are now extended to wrought iron and steel; a final report is proposed, to consider the nature of the chemical changes induced on cast and wrought iron by the action of sea water, and to complete the numerical results now given, which have lately been in several instances submitted to control, or tested by the actual corrosion of castings recovered from the wrecks of the ***Edgar*** and ***Royal George***, &c., and found strikingly to coincide.

Mr. Grimes described Dennett's Rockets for preserving lives from shipwreck, and read a letter from Capt. Denham, stating that the range of these rockets exceeded that of the mortar by 100 yards, the range of the rockets being about 350 yards, while that of the mortar was but about 250.

Dr. Wallace on Arches. The object of this paper was to exhibit a method for geometrically constructing a catenary. After explaining his method, Dr. Wallace stated that he was about to publish a set of tables for constructing the catenary, and also for suspension bridges.

MR. WALLACE exhibited and explained his smoke protector.—Mr. Hawkins exhibited and gave an account of Mr. J. R. Bakewell's instrument for measuring the angles of the dip of strata.—Mr. Rayner exhibited a machine for regulating the speed of machinery in cotton-mills, &c.—Mr. Smith, of Deanston, exhibited a model of a new canal lock, the advantages of which he stated to be, that the descent in each lock would not be more than twelve to eighteen inches—that the locks were opened by the passage of the vessels—that the locks shut of themselves—that the vessels did not require to stop—and that little or no water was lost. The lock gate is hinged at the bottom, the upper portion, which is round, floats at the level of the higher part of the water, and is pressed down by the bow of the vessel in passing, and when it has passed, rises to its former position.

"*Experimental Inquiry into the Strength of Iron, with respect to its application as a Substitute for Wood in Ship-building.*" By Mr. Fairbairn.

The number of vessels which of late years have been made entirely of iron, and the probability of the greatly extended use of this metal in ship-building, renders it desirable to attain additional knowledge as to its power to resist these strains to which it is subjected, in its application to the purposes above stated. Mr. Fairbairn's experiments have convinced him, that in proportion as the public become better acquainted with the valuable properties of this material, and its fitness for almost any purpose of naval architecture, they will be convinced that it is safer, and, perhaps, more durable than timber, and that confidence in it will be completely established. To meet the requirements for this purpose, the following series of experiments have been undertaken, and in a great measure completed. Part only, however, could at present be laid before the Section. 1st. A series of experiments on the strength of plates of iron, as regards a direct tensile strain, both in the direction of the fibre and across it. 2nd. On the strength of the joints in plates rivetted together, and on the best modes of riveting. 3rd. On the strength of the various forms of ribs or frames used in ship-building, whether wholly composed of iron, or of iron and wood. 4th. On the resistance of plates to compression and concussion, and on the power necessary to burst them. The experiments were superintended by Mr. Hodgkinson, to whom Mr. Fairbairn acknowledged himself indebted for many of the results.

On Strength of Iron Plates.—In these experiments all the plates were of uniform thickness. Their ends had plates rivetted to them on both sides, with holes bored through them perpendicular to the plate, in order that they might be connected by both, with shackles to tear them asunder in the middle, which was made narrower than the rest for that purpose. The results were as follow:—Mean breaking weight in tons per square inch, when drawn in the direction of the fibre.

		Tons.	
Yorkshire	plates	25·77	Mean 22·52 tons.
Do	do.	22·76	
Derbyshire	do.	21·68	
Shropshire	do.	22·83	
Staffordshire	do.	19·56	

Mean breaking weights in tons per square inch, when drawn across the fibre:—

Yorkshire	plates	27·49	Mean 23·04 tons.
Do.	do.	26·04	
Derbyshire	do.	18·65	
Shropshire	do.	22·00	
Staffordshire	do.	21·01	

The foregoing experiments show that there is little difference in the strength of iron plates, whether drawn in the direction of the fibre or across it. Mr. Fairbairn then gave the results of a long series of experiments on the strength of riveted plates. The same description of plates was here used, as in the previous experiments; the plates were however, made wider than the former, in order that they might contain (after the rivet-holes were punched out) the same area of cross section as the previous ones. Mean breaking weights in pounds, from four plates of equal section, rivetted by a single row of rivets:—

20127	Mean 18590 lb.
16107	
18982	
19147	

The mean breaking weights in pounds from four plates of equal sections to the last, but united with a double row of rivets:

22699	Mean 22258 lb.
23371	
20059	
22902	

Whence the strength of single to double riveting is as 18590 : 22258. But from a comparison of the results taken from the whole experiments, the strength derived from the double rivetted joints was to that of the single as 25030 : 18591, or as 1000 to 742. Comparing the strength of plates alone with that of double and single riveted joints, Mr. Fairbairn gave their relative values as under:—

For the strength of the plate	100
For that of double riveted joints	70
And for the single riveted joints	56

Hence the strength of plates to that of the joints, as the respective numbers, 100, 70, and 56. Mr. Fairbairn then gave a table containing the dimensions and distances of rivets for joining together different thicknesses of plates.

A discussion ensued as to the comparative strength and safety of iron boats. Mr. Fairbairn stated, that from the manner in which the sheathing is rivetted, the whole vessel becomes one mass; and though he did not come forward as the advocate of iron against wood, he would state that he considered iron as one-third stronger than wood, weight for weight.—Mr. Grantham knew iron boats that had lasted 28 years in fresh water.—Mr. Taylor built an iron boat for a canal in 1805, and it was now in good condition.—Mr. Mallett had found, from his experiments on the action of sea water upon iron, that the duration of a half-inch plate in sea water would be about 100 years.

Mr. Hodgkinson read a paper "*On the Strength of Pillars of Iron.*" This was an abstract of a paper by Mr. Hodgkinson, read at the Royal Society, of which we gave an abstract at the time.—(See Journal, No. 34, page 248.)

Mr. Fairbairn "*On raising Water from Low Lands.*" The commissioners for draining the Lake of Haarlem having applied to Mr. Fairbairn on the subject, he proposed a method where the water is raised by a large scoop, which rises on the descent of a weight, which weight is raised by steam power, on the Cornish principle. It is calculated to raise 17 tons at each stroke. Mr. Fairbairn exhibited a model in illustration.

Mr. Taylor mentioned, that he had that morning received a letter from Mr. Enys, stating that commissioners from the Dutch government had visited Cornwall, to ascertain the duty done by the Cornish engines. Several experiments had been made at their request, and the following was the result.

			Feet stroke.	Lifted one foot.
Wheal Vor, Borlase's engine..	80 in.	single	8·0	123,300,593lb.
Fowey Consols, Austin's	80	„	9·0	122,731,766
Wheal Darlington Engine ..	80	„	8·0	78,257,675
Charlestown United Mines ..	50	„	7·5	55,912,392
Ditto Stamping engine......	32	lifting 66 stamps		60,525,000
Wheal Vor, ditto	36	dble. lifting 72 stamps		50,085,000

Mr. Glynn stated, that by a scoop wheel 25 feet diameter, and 80 horse power, used by him in Lincolnshire, 4½ tons of water were raised in a second, the difference of level being about five feet.

Mr. Hawkins exhibited a Model of a Railway and Carriage, recently patented by Mr. Rangeley, and by him called *the Safety Rotation Railway;* which is an inversion of the ordinary construction, inasmuch as wheels are made to revolve on fixed bearings, placed in two parallel lines along the road; and the carriage, without wheels, is built upon a pair of running rails, carried along upon the peripheries of the train of wheels kept in revolution by steam-engines fixed at every mile or two of the road. It is intended to have the wheels three feet diameter, and three feet apart, which will give 1760 wheels on a mile. They are to be driven by a succession of endless bands, one band in every case passing around two pullies attached to every two contiguous wheels. The carriages are designed to hold forty passengers each, with their luggage; the whole, including the carriage, not to exceed five tons: the running rails always to bear on eight or ten wheels, so that no wheel shall have to support more than about ten or twelve hundred weight. The wheels, therefore, need not weigh more than half a hundred weight each, to be sufficiently strong for supporting the carriage. It is found by experiment, that three ounces suspended from the periphery of such a wheel, causes it to revolve. Any weight that sets a wheel in motion, will, if continued, cause the same to revolve with accelerated velocity, until the resistance of the atmosphere becomes equal to the accumulated force, after which, a steady speed will be kept up. It is inferred from observation, that the wheels driven with a continued force of three ounces each, would acquire a constant speed of about thirty miles an hour. It is also ascertained from experiment, that eight pounds would draw a ton weight on four three-feet wheels running on level rails, and thus that a force of forty pounds would draw the carriage. The following table is constructed from data, by which it is found that seventeen horse power of steam-engine is required to turn each mile of wheels, and two horse power to drive each carriage. The power to turn the wheels, is neither increased by additional carriages nor by acclivities; each carriage added, taking only two horse power more to carry it along upon a level; and an acclivity of 1 in 180 doubling, 1 in 90 quadrupling, and 1 in 45 octupling only the tractive force, without in any case requiring more than the seventeen horse power to turn the wheels.

Carriages Every 2 Minutes.	PASSENGERS.		HORSE POWER. Per Mile in 2 Minutes.			
	Every 2 Minutes	In 12 Hours.	On a Level.	Up 1 in 180.	Up 1 in 90.	Up 1 in 45.
1	40	14,400	19	21	25	33
2	80	28,800	21	25	33	49
3	120	43,200	23	29	41	65
4	160	57,600	25	33	49	81
5	200	72,000	27	37	57	97

The Britannia.—This steamer has brought to Havre from London an iron steamer in 372 pieces. The vessel, which is destined for the Lake of Geneva, will be 135 feet long, and these materials are to be transported thither forthwith.

REVIEWS.

Penny Cyclopædia. Part 92. Article "PORTICO."

UNLESS the style adopted prohibits the introduction of such feature, a portico is now considered almost a *sine qua non* in a design; ample proof of which being the case was afforded by those for the Royal Exchange, the Assize Courts at Liverpool, &c.; and yet, whether in designs or executed buildings, we very rarely find any attempt at originality, or any fresh combinations in regard to plan. On the contrary, nearly all our porticoes consist merely of a single range of columns in front, and it is fortunate when that disposition of them is attended with the negative merit of there being no disagreeable drawback on the effect aimed at by them, resulting from a mean background to the external elevation. In fact, notwithstanding that so very much depends upon them, and almost endless variety may be obtained from them, *plan* and *background—i.e.* the interior elevation of the portico—have scarcely any study or attention at all bestowed upon them. We trust, however, that the very excellent article which has just appeared in the Penny Cyclopædia—a work which has already more than once obtained our notice and approbation for the architectural information it contains—will not be thrown away upon the profession, but spirit them up to endeavour to get out of their old routine course, and give us something more than six or eight columns, put beneath a pediment.

When we inform our readers that the article in the Cyclopædia extends to several pages, we hardly need observe that it is altogether original, for we know of no other work of the kind which contains much more than a mere definition of the term itself, while here in addition to the information brought together, there is a very great deal of able comment and criticism. Even were there nothing else to recommend it, this article would deserve to be noticed by us on account of the novel and ingenious terms invented by the writer to express clearly at once, of what kind a portico is, as regards its flanks, and its projection from the building to which it is attached. For this purpose he makes use of the terms *Monoprostyle, Diprostyle, Hyper-diprostyle, Triprostyle,* &c., the first indicating the simplest form of prostyle, namely, that which projects only one intercolumn before the building; the second, that which projects two intercolumns, and so on. By this most convenient innovation in architectural terminology,—and therefore likely to be generally adopted at once,—the plan of the portico of St. Martin's Church, would be clearly described by terming it Hexastyle Diprostyle, that is, having six columns, or five intercolumns in front and two intercolumns at its flanks, consequently one column there besides that at the angle. A *Triprostyle* has of course three open intercolumns at its sides; but the meaning of *Hyper-diprostyle* requires some explanation,—after which it becomes obvious enough, this term being coined by the writer to express that besides having two open intercolumns, the portico is advanced from the building by an additional space, whether equal to a third intercolumn or not: thus the portico of the National Gallery is described as a Corinthian Octastyle, *Hyper-diprostyle,* and with regard to its interior as having a distyle in antis within it,—that is, a recess of three intercolumns, produced by two columns between antæ.

The article is illustrated with a great many plans, showing various arrangements, and is further accompanied with a table of some of the more remarkable examples, which we shall here give, referring our readers to the Cyclopædia itself for the rest of the article, not doubting that they will procure the number which contains it.

TABLE OF PORTICOES.

Class.	Order.	Building.	Architect.	Remarks.
Dodecastyle	Corinth.	Chamber of Deputies, Paris	Poyet	Monoprostyle, sculptured pediment.
Decastyle	..	University College, London	Wilkins	Hyper-diprostyle, recessed. Height of columns 30 feet.
Octastyle	..	Pantheon, Rome	......	Hyper-triprostyle. Polystyle and recessed.
..	..	National Gallery, London	Wilkins	Hyper-diprostyle, with distyle in antis, recess within.
..	..	Fitzwilliam Museum, Cambridge	Basevi	Monoprostyle, recessed, and with order continued laterally, forming three intercolumns on each side.
..	..	Victoria Rooms, Bristol	Dyer	Unequal diprostyle, recessed, five intercolumns.
..	..	Exchange, Glasgow	Hamilton	Diprostyle, with two inner columns corresponding with second and seventh of the octastyle.
..	..	Buckingham Palace	Nash	Columns fluted, their height 26 feet
Octastyle-Peripteral	..	Birmingham Town-hall	Hansom and Welsh	Columns 36 feet high. Side elevations of twelve intercolumns on flanks.
..	..	La Madeleine, Paris	Huvé	See PARIS.
..	..	Girard College, Philadelphia	Walter	Columns 55 feet high; marble.
..	Doric	The Walhalla, Bavaria	Klenze	
Octastyle	Ionic	Glyptotheca, Munich	Klenze	Monoprostyle, polystyle, recessed, tetrastyle in antis.
..	..	Great Theatre, Petersburg	Thomond	Monoprostyle.
..	Doric	Church at Possagno	Canova	Diprostyle, polystyle, double octastyle.
..	..	Manège, Petersburg	Quarenghi	Monoprostyle, polystyle, recessed.
..	..	Royal Institution, Edinburgh		
Hexastyle	Corinth.	St. Martin's, Charing-cross	Gibbs	Diprostyle, height of columns 34 feet.
..	..	St. George's, Bloomsbury	Hawksmore	Diprostyle, five arched doors, and five arched windows above them.
..	..	St. George's, Hanover Sq.	J. James	Monoprostyle.
..	..	Law Courts, Dublin	Cooley and Gandon	Monoprostyle.
..	..	Kazan Church, Petersburg	Voronikhin	Diprostyle, polystyle, a triple hexastyle.
..	..	Pantheon, Paris	Soufflot	Reliefs within portico, height of columns 62 feet.
..	..	Madre di Iddio, Turin	Buonsignore	A diprostyle, attached to a rotunda. Two inner columns behind the penultimate ones in front.
..	..	Custom-house, New York	W. Ross	Monoprostyle. White marble; columns 32 feet high.
..	..	St. Nicholas's Potsdam	Schinkel	Hyper-monoprostyle.
..	Ionic	Bethlem Hospital, London	Lewis	Monoprostyle; height of columns 36 feet.
..	..	Post-office, London	Smirke	Diprostyle, recessed, columns 37 feet high.
..	..	Theatre, Berlin	Schinkel	Monoprostyle, flight of steps in front.
..	..	East India House, London	Jupp	Pseudo-prostyle; height of columns 30 feet.
..	..	St. Pancras' Church, London	Messrs. Inwood	Monoprostyle; florid Ionic; columns 36 feet high.
..	..	Royal Institution, Manchester	C. Barry	Monoprostyle. Order continued laterally, forming loggias of three intercolumns on each side of prostyle.
..	..	Post-Office, Dublin	F. Johnston	Monoprostyle, columns 36 feet high, fluted.
..	..	Raadhus, Copenhagen	Hansen	Monoprostyle; deep recess in centre with steps.
..	Doric	Colosseum, London	D. Burton	A monoprostyle attached to a polygon.
..	..	Hunterian Museum, Glasgow	......	Monoprostyle, recessed, with a distyle in antis.
..	..	County Hall, Chester	T. Harrison	Monoprostyle, polystyle, recessed. A double hexastyle.
..	..	Wacht-Gebaude, Berlin	Schinkel	Monoprostyle, recessed as a tetrastyle in antis.
Pseudo-hexastyle	Corinth.	Front of Roman Catholic Chapel, Finsbury Circus	......	Four pilasters and two columns beneath a pediment, or five intercolumns.

Papers on Iron and Steel, Practical and Experimental. By David Mushet. London: Weale, 1840.

Second Notice.

Iron possesses among metallic products the same pre-eminence which cotton has over those of vegetable origin, and has for many centuries been one of the great staples of our foreign trade, and a main supporter of our internal industry; to the progress of this manufacture in our own country we shall subsequently have occasion to refer, we shall now therefore call attention to its origin elsewhere. Mr. Mushet in his fourteenth paper combats the traditional account of the discovery of iron in Greece by the accidental burning of a forest, and gives a probable theory so well confirmed by experience here as to carry with it a high degree of authority. I have seen, says he, a mass of perfectly malleable iron produced by roasting a species of ironstone, united with a considerable quantity of bituminons matter. After a high temperature had been excited in the interior of the pile plates of malleable iron of a tough and flexible nature were found, and under circumstances where there was no fuel but that furnished by the ore itself. Mr. Mushet thence argues the possibility of the properties of the metal having been discovered during the process of making charcoal by a mass of ore accidentally dropping into the burning pile. Iron, it is most probable, was for a long time after its discovery applied solely to agricultural purposes, for the want of a regular method of converting it into steel long gave a preference to hardened copper and its alloys as the material for edged tools and instruments of war. So little indeed was the art of making steel advanced, that a present of 40 lbs. of steel from Porus to Alexander is quoted by biographers as a most acceptable and valuable gift.* Even in India itself where this branch of art is now carried on upon a very extensive scale, the progress seems to have been very slow, for the value of that gift of Porus would now be the produce of one man's labour in 240 days. It is to India however, that according to the best authorities we are to look for the origin of steel, and from which other countries were supplied; even the obelisks of Egypt being supposed to have been worked with Indian tools. Among ourselves the production of iron claims a very early date, for there is every probability of the Cornish mines having been worked at least 2300 years ago by the Phenicians, while we know by the testimony of Cæsar† that this branch of mining was still pursued by the nations inhabiting Britain. The current money was of brass or iron, valued according to weight, although Cæsar observes that the produce of this latter metal, which was worked in the maritime districts was small. As however the tin trade had long been a staple, and copper and brass were imported, it may be reasonably doubted whether among a mining population, the workings were, although rude, carried on upon a greater scale of magnitude than is implied from the terms used by the Romans. During the subsequent occupation by the Romans, remains now existing fully attest that the workings were kept up by them, and indeed during the whole period of history there seems to have been no intermission in the prosecution of this branch of the national wealth and strength. The Danes are particularly noted in this pursuit, and large heaps of scoria, named after them, are to this day to be met with in many parts of England, with so great an accumulation of soil upon them as to bear trees of large size. At the time of the Norman accession we find the king demanding of the inhabitants of Gloster 36 icres of iron, for making nails for his fleet, every icre to consist of 10 bars or rods of iron; which iron was very probably made in the neighbourhood in the Forest of Dean. The kings of England held in this forest iron works, consisting of three blast furnaces and two forges, which are supposed to have been given up by Charles 1st, somewhere about the year 1637. Cromwell and other princes are also said to have embarked capital in such pursuits, and indeed the iron trade seems always to have been the object of the highest solicitude.

One of the first events which led to an extension of the iron trade, particularly as regards castings, was the invention of cannon, the precise date of which is not however known. Cast iron is said by M. Verlit to have been known in Holland in the 13th century, and staves to have been cast from it at Elass in 1400, but how produced is not known. Cannon are mentioned in a record of the accounts of the Chamber of Paris in 1338, and were used by the English at Cressy in 1346, and by the Venetians in 1366 and 7, but we are by no means to conclude that such cannon were cast, as for two hundred years hooped cannon were made, formed of staves of wrought iron, bound together with strong hoops of the same metal. It was not until 1547 that the first iron guns were cast in London by a person named Owen. The precise date of the origin of the blast furnace is far from being ascertained. Mr. Mushet who has investigated the subject with his usual research, seems to be of opinion that it cannot be beyond the beginning of the seventeenth century. It is then that we perceive a fresh epoch in the progress of the manufacture, as a greater power of blast was required, the old situations would be abandoned, and the iron trade pass from the township in the neighbourhood of the mines to the banks of the adjacent streams; this is particularly evident from examining the sites of the oldest workings. The introduction, or invention of the blast furnace here, for we seem to have some claim to its first use, was productive of a great extension of the trade; a great exportation of iron artillery to the continent was the result, and without giving implicit belief to the statements of Dudley, in his Metallum Martis, we are still bound to believe that the trade was great. According to Dudley's computation in 1615, there were then no less than 300 blast furnaces for smelting iron ore with charcoal, and 500 forges and iron mills. The total quantity of iron produced from the works is said to have been 180,000 tons per year, an enormous amount considered in relation to the then population of the country, although not impossible so far as the question of fuel is concerned. Supposing Dudley's statement of the number of furnaces to be accurate, although some question may be raised upon that point, a deduction is still to be made for furnaces out of blast and building, for which, from modern experience we might easily assume the deduction of a third, leaving 200 as the actual number in work. A less number of weeks (perhaps 35), and a lower average (say 12), should also be taken, and the estimated produce would then not exceed 80,000 tons, a quantity by no means incredible. It may be mentioned here by the way that the extensive exportation of artillery is not only in favour of the origin of blast furnaces in this country, but also of our possessing a very large share of this trade, which might well give an impulse to it in this country.

We have now to contemplate the history of another great improvement, the use of pit coal, for which we find several patents granted by James I. In 1612 a patent was granted to Simeon Sturtevant, Esq. (seemingly a Dutch name) for 31 years for making iron with pitcoal, in return for which patent Sturtevant was bound to publish his discoveries, which appeared in a quarto form under the name of "Metallica." In the next year Sturtevant, having tried his plan upon a large scale and failed, was obliged to give up his monopoly. John Ravenson, Esq., was the next in the field, and was also enjoined by his patent to publish his discoveries, which he did under the title of his "Metallica." Several other candidates also failed, when, in 1619, a new competitor came into the field, who was destined to excite more attention. Dudley's father possessed iron works at Pinsent, in Worcestershire, and it was there that Dudley perfected the patent which he obtained in 1619. He declared that although he made only at the rate of three tons of pig iron weekly, that he made it with profit. His success was such as to excite the alarm of the charcoal iron manufacturers, who formed a powerful opposition, and obtained a limitation of his patent from 31 to 14 years, new adventurers also sprang up to encroach upon his rights, until at last their rivalship, and his attachment to the cause of Charles 1st, prevented his improvements from being followed up. In the meanwhile the deficiency of wood had begun to be felt, and Dudley had fully proved the efficacy of his plan for the manufacture of pig and bar iron, and for various castings, all of which he sold much lower than the charcoal-manufacturers. In the article of castings alone, Mr. Mushet says, he must have had greatly the start of the charcoal foundries, as the quality of carbonated coke pig iron is far superior to that of the charcoal iron of this country for the general purposes of casting. Such success greatly provoked the hostility of his rivals, particularly of those who still possessed a good supply of fuel, who at last in the true spirit of combination led on an attack upon his devoted works, and led to the evil results to which we have alluded. His improved bellows, forge, &c. all fell a prey to the lawless banditti. While he was thus openly plundered, his rivals were not less active in endeavouring to undermine him, or at least profit by his success by evasions of his patent. Among these attempts that of Captain Buck, Major Wildman and others is a singular instance of failure. Attacked on all sides Dudley was also foiled in 1663, in his last attempt to obtain a patent from Charles the Second, and deserted by all,he was compelled to give up the pursuit.—Dudley was the author among other works of the "Metallum Martis," in which we possess many curious details of the early state of the trade. We may here pause and view the present state of the charcoal iron manufacture, which from 310 furnaces has dwindled down to insignificance, so as to be almost extinct, the whole annual quantity manufactured not exceeding 1000 tons. In Lancashire, two or three furnaces are occasionally in blast, and one in Argyleshire. The purposes to which iron made from this fuel is now applied are limited indeed. In Lancashire a small quantity of steel iron for the Sheffield market has of late years been made from it; but the principal consumption is for casting knives, forks, razors, snuffers, bridle bits, stirrup irons, &c. These articles, after having been cast, undergo a process of deoxidation, which gives them a surprising degree of tenacity, with great flexibility and a capacity of polish resembling steel; those castings, not intended to receive a polish, present surfaces capable of receiving and retaining tin for a considerable length of time.

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* Quintus Curtius, B. 9. ch. 25. Ferri candidi talenta centum.

† De Bello Gallico, L. 5, c. 10.

To return to the date where we left off, we may observe that the improvements which had been made had increased the power of the furnaces, from which as well probably as from their concentration a diminution had taken place in their number. In a prospectus drawn up about the year 1720, near the time of the South Sea Bubble, we find the number of furnaces rated at only 59, but as this list is manifestly imperfect, we are perhaps bound to consider the number as larger. Sussex, Kent, and Hampshire were then the seat of 15 furnaces, now of not one. Resuming the history of pitcoal iron we find that after the time of Dudley, nothing of importance was done until 1740, when a new auxiliary, the steam engine, had come into the field. The application of this machine gave the manufacturer greater liberty in selecting the site of his works, and enabled him to erect larger furnaces with a proportionate quantity of blast. From this date the use of pitcoal every year became more prevalent, and has ended by superseding charcoal in this country. In aid of this two other circumstances operated with advantage, the introduction of Mr. Watt's double blast engine, and the invention of puddling and rolling bar iron by Mr. Cort.

In our own days improvements not less important have been effected, and since the commencement of the literary career of the author, whose work is now before us, the quantity of pig iron necessary to produce a ton of bar iron has been reduced from 40 cwt. to 26 or 27 cwt., with almost as great an economy of fuel. This has principally been accomplished by means of the hot blast, the use of which however can be only considered as recently established, so strong was the prejudice against its application. One great property it possesses is that it diminishes the quantity of vitreous matter formerly required in the furnaces, so as to diminish the consumption of both fuel and limestone. An equalization of the blast is another result, so as to diminish the effect of the atmospheric influence, which it is well known interferes with the operations of the furnace. In this, as in other countries, a larger produce of cast iron is obtained in the winter months than during the summer or autumn, while the quality of the metal is improved by being much more carbonated and less fuel is consumed. During the months of June, July and August, more especially in hot seasons, the quality of the iron in this country will be depreciated 30 per cent., and the quantity very considerably reduced, and in many parts of Sweden, says Mr. Mushet, when the summer heats are intense, the manufacturer is obliged to blow out or stop his furnace for two or three months; not only is he unable to make carbonated metal, but is frequently incapable of keeping the furnace in such trim as to make a produce of any quality whatever.

An improvement scarcely inferior in importance, although only local was the discovery by the author in 1801, of the Mushetstone or Black Band ironstone, a new class of carboniferous ironstone, principally found near the river Calder, near Glasgow, but also in South Staffordshire, North Wales, and North Staffordshire, in which latter district it is called Red Mine. Although used by Mr. Mushet in the Calder iron works, so strong was the prejudice against it that it was not until 1825 that its application was at all extensive. It is now used in about 50 furnaces in Scotland, and the quantity of iron produced is above 100,000 tons; on one estate alone £12,000 is received as royalty in consequence of this discovery. A powerful auxiliary in the hands of the Scotch masters has been the use of raw pit coal, and coking under dust, which have been found to be particularly suited to the Scotch coal and iron. A dawning discovery and one which promises to be not less important than that of the Mushetstone, is Mr. Crane's process for smelting iron with anthracite, thus making available a large supply of mineral wealth, and extending our national resources.

A Practical Inquiry into the Laws of Excavation and Embankment upon Railways, being an attempt to develop the natural causes which affect the progress of such works, &c. By a a Resident Assistant Engineer. London: Saunders and Otley, 1840.

It may be laid down as a general axiom that in every inquiry of this nature, the degree of dependance which shall be placed upon the laws established, should be proportionate to the extent and generality of the experiments on which such laws are founded.

If we take as our groundwork the gross performances of a long series of months during which the attendant circumstances as to weather, state of the earth, as it may be wet or dry, adhesive, loose, or crumbling, and so troublesome or otherwise in filling and teaming, with all the other circumstances by which earth-works are affected, we shall be able to deduce from these in connection with detailed experiments upon the requisite particulars of getting, filling, teaming, and times of travelling, a tolerably perfect set of expressions by which calculations may be made with reference to earth works in general.

It must be borne in mind, however, that all results derived from such expressions, however accurately determined, and however comprehensive the data from which they have been derived, are still liable to be affected by circumstances which no human foresight can predict. All that can ever be with safety relied upon is, that supposing all attendant circumstances to be identical as to effects with those which had place during the period of former observations, then that the calculations applied to other works varying in form and magnitude, shall give results agreeing with such former observations.

But if we attempt without reference to the gross performance during some long period, to derive from the observation of a few days, fixed laws for the actual time of executing large works, it is obvious how impossible it must be to derive correct results in any such way. The days during which the observations have been made, may have been remarkably fine or remarkably unfavourable, or in some intermediate stage between these. But whatever this stage may have been, there is no alternative but to adopt them as our standard for the whole year, and thus it will be seen on what an unstable foundation such a structure must be raised.

We do not mean to say that any experimentalist would so far stultify himself as to proceed blindly on the isolated experiments of certain days on which the performances would notoriously be either much less or much more than on the average of the year, but we can readily imagine that the imputation of improper selection can scarcely fail to apply more or less to the experiments of any 10 or 12 single days at any period of the year. Let us suppose on the one hand one of the dull gloomy days of our winter months, the ground slowly parting with the frost which had hardened it for some weeks before—the falls of earth possessing more than usual tenacity, the workmens' tools clogged with the soft retentive clay adhering to every thing like bird lime; the rails clammy and dirty from the same cause, the wagons when teamed retaining a third of their contents plastered to the sides and bottom, and so requiring double the time for teaming, and then let us with this contrast a fine dry day of spring or autumn, the rails almost free from dirt, the shovels all clean and bright, and parting instantly with the contents filled into the wagons. These latter again when tipped immediately discharging their contents, and leaving none to be shovelled out by the teamers. And let us ask any man, practical or not practical, on which day the performance will be greatest. We shall not hesitate to say that the performance on the one day shall be 50 per cent. more than on the other, and shall be independent of the number of hands employed, because assuming that on the favourable day each department of the labour is occupied by the proper proportion of men and horses, then on the unfavourable day an increased number will rather serve to impede than to hasten, as they will be in each others way, and the hands will at intervals have to wait for their turn to exert themselves, it being impossible that more than a certain number at a time can be fully employed.

We repeat we have no intention of charging the experiments before us, or any other of the same kind with such glaring absurdity as would attach to them, did they exhibit the extraordinary results of one or other of the extremes we have pointed out as a foundation for estimating the work of the year, but we contend the chances are, that as isolated experiments they bear more or less to one or other of the extremes. It is barely possible that the days selected shall represent a fair average of what may be done throughout the year.

It is for such reasons that we would hesitate before adopting as the basis of important calculations, the results of a few days observation.

We would much rather rely on well authenticated records of the performance during many months, under different systems of working, and we would suggest to the author of the present treatise, and to all others who may in future undertake experimental inquiries of this nature, that the really practical and experienced, whether engineers or contractors, will invariably. as their test upon the accuracy of any particular theory, however derived, proceed at once to compare the results which such a theory will give them with their own actual knowledge of what has been done on the great scale in other works. They will therefore pronounce the theory correct or otherwise, according as it coincides or disagrees with their own experience. We are thus over and over again impressed with the importance of founding all theories upon the actual performance of as long a period as possible.

Let it not be understood that we are here objecting to experiments in detail. These are exceedingly useful, because placing as they do before our eyes the precise amount of time occupied in all the various tages through which the soil passes from its original position in the cutting till it is finally placed in the embankment, we are better able justly to apportion the quantity of labour necessary in each several department, and so to economize both time and money.

Our author professes to have selected the experiments he has given from a much more extensive series, and this may possibly be held as an answer to our objections, as to the limited space over which the experiments extend, but it must be understood we are not objecting to the insufficiency of these experiments, for the purpose of showing the distinct periods of time occupied in the several processes of filling, tipping, and travelling; the real meagreness of the experiments, we conceive, arises from the absence of all information as to the gross performance of some long periods. It is obvious that with such information, even should the results not agree with those which might be derived from calculation by the author's formulæ, these latter might still be of service, as expressing the ratio of the times occupied by the various details of earthwork operations, and this, we apprehend, is almost the extent of what can be expected from the experiments we are considering.

Thus should we find that the calculations on being applied to any particular work already executed, shall afford a less result in point of performance than we actually know to have been accomplished, we may still perhaps rely upon the numercial relation to each other of the several times determined in the experiments, which form the basis of such calculations. We may conclude that the separate times assumed for filling, teaming and travelling are all too great, but that they may all safely be reduced in a certain ratio: and when so reduced we may be satisfied with the conclusions they establish. Thus for purposes of comparison as to the amounts of labour which can most advantageously be employed in the several departments of earthworks, we hold the experiments in this book to be extremely useful, and we think with the restriction we have laid down against applying them to establish gross results, that they may be safely depended upon.

We will now briefly describe the mode of investigation pursued in this work.

From the observations of sixteen days the author proceeds to establish first the rate of speed at which the wagons travel, and then the time occupied in tipping each wagon, or each set of wagons, supposing a sufficient number of men at the teaming place to prevent unnecessary delay. His method of deriving the rate of speed is neat and ingenious, and liable to less objection than actual observation on the time of passing between fixed points. For instance, the time occupied in "filling, removing, and tipping the wagons," as the average of several experiments, on a lead of half a mile, was 55 minutes. Also the time occupied in filling, removing, and tipping the wagons on a lead of three-quarters of a mile, amounted to 69·47 minutes. Hence we have 69·47 — 55 = 14·47 minutes for the difference between the time required for filling, removing, tipping and bringing back a set of wagons upon a lead of three-quarters of a mile long; and the time required for filling, removing, tipping and bringing back a set of wagons upon a lead of half a mile long. This difference, namely, 14·47 minutes is evidently the time which elapsed while the horses were drawing the loaded and empty wagons backwards and forwards over a quarter of a mile, or in fact the difference in the lengths of the leads.

"This shows that the average speed of transit rates at 2·40 miles per hour."

We regret to be under the necessity of pointing out that the author has here made an error in calculation, as may at once be verified by ascertaining the rate of speed corresponding to half a mile in 14·47 minutes. This rate will be found equal to 2·07, instead of 2·40 miles per hour; a material difference, and one which must affect any subsequent calculations founded upon it. We believe that the rate made use of by the author, namely, 2·40, is more correct in practice than the other, but this tends rather to weaken our faith in the experiments, since they undoubtedly, by the author's own showing, establish 2·07 miles per hour as the rate of horses' speed in transporting earth. To proceed, the time of tipping is then found = 7·06 minutes, and that of filling = 19 minutes, both these being derived, independently of the rate of speed, and so not affected by the error we have pointed out above.

From the data thus established, our author derives in a simple manner, the necessary expressions for finding the number of wagon loads which may be removed from cutting to embankment in a given time, with a given number of wagons, both for constant and varying loads.

The next section is devoted to the investigation of the causes which limit the rate of progress in forming an embankment. The author shows that this rate of progress is limited by the number of teaming, or as he terms them shunt roads, which can be fixed at the end of the embankment, and this number will of course depend upon the height, top breadth, and rate of slopes of the embankment, as affording a greater or less breadth to team over. The breadth occupied by each road, he assumes at 8 feet, so that the whole breadth available for teaming over being divided by 8, will give the number of roads which can be laid down.

It will now be necessary to notice the author's hypothesis as to the available breadth of the teaming or battery head. He assumes that most soils will stand at a slope of 1½ to 1, when first tipped, and as most embankments are to be finally dressed off to flatter slopes than this, the difference between the base for a slope of 1½ to 1, and that for the slope to which the embankment is to be finally dressed off will be so much additional breadth, which being added to the top breadth will give the whole available breadth for teaming. Thus for an embankment 40 feet high, slopes 2 to 1, and top breadth 30 feet, we shall have $\overline{40\times2\times2+30}-\overline{40\times1\tfrac{1}{2}\times2}=190-120=70$ feet, the available breadth for teaming over in this case.

This brief analysis contains, we believe, the elements of the author's theory, as to the limits of progress in an embankment, for taking 7·07 minutes as the time of tipping a set of wagons, it is evident that 84·8 can be tipped from each shunt road in a day of 10 hours.

The number of wagons that can be tipped per day from each shunt road, being multiplied by the number of these roads, gives the total number of wagon loads that can be tipped per day from all the roads, and this number being multiplied again by 250, the working days in a year, gives the whole performance in wagon loads per annum.

The quantity in cube yards depends of course on the capacity of the wagons, which varies from two to three cube yards, according as they are heaped or not, and according to their build.

Our opinion of this part of the author's work is principally influenced by comparing the gross results which his calculations establish as to the rate of progress, with what we know to have been the actual performance in cases where every effort was made to get through as large a quantity of work as possible. Taking the case of an embankment 50 feet high, slopes 2 to 1, and top breadth 30 feet, it would appear by the formulæ that we have been considering, that 848 wagon loads, or say (at the most moderate allowance for each wagon) 1696 cube yards per day of 10 hours, can be tipped at each end of the embankment. We think our author would be somewhet puzzled to point out an instance where even two-thirds of this amount has ever been performed, under the circumstances we have supposed, even for a single day, much less during any long continued period.

There is some difficulty in comparing the formulæ in detail with actual performance, for the want of knowing the breadth of tip in the latter cases. There is however one well authenticated example which may be found in the evidence of Mr. Provis, on the London and Brighton Railways.

We allude to his description of the great Skelmere embankment on the Birmingham and Liverpool Canal, where he states, that over a breadth of 60 feet, 105,000 yards were teamed in 16 weeks during fine summer weather, being at the rate of 1094 cube yards per day.

"During one month," however, says Mr. Provis, "we worked double gangs, beginning at three in the morning, and ending at ten at night." So that this quantity reduced to days of ten hours in length, becomes 105,000 in 120 days, equal to 875 yards per day. It must be remembered that Mr. Provis was here certainly not *understating* the performance on this work. It was his interest to show the greatest possible quantity which had ever before been accomplished, and the fact he relates was considered at the time, as indeed it is entitled to be considered now, a wonderful and almost unexampled performance, exhibiting no small share of contrivance and energy on the part of those directing the operations.

We shall only further remark that up to April 1837, no instance could be found where even 200,000 yards had been teamed into embankment from one face in a year; whereas our author's formulæ for an embankment of the dimensions last described, would lead us to calculate taking 250 working days in a year, as a performance of 424,000 yards per annum, and this too without nightwork, but simply during 250 days of 10 hours each.

The difference between actual experience and the results of our author's experiments arises here, we conceive, principally from the use of the constant 7·07 minutes as the time of tipping. This time may be perfectly correct as applicable to small embankments, and a few sets of wagons where there is no danger that either men, horses, or wagons will ever be in each others way, but we conceive it is quite inapplicable to large works, where interruptions to the regularity of proceeding would inevitably be very frequent, if the wagons were worked with the proper complement of labour to ensure the condition that no instant of time shall be lost at the teaming place. Thus it will ever be found that the theory here laid down furnishes results as to gross performance, which must not be expected in practice.

The second part of the work commence with an inquiry into the effects of the lead, principally as determining the number of wagons to be employed for different lengths of lead. Without accompanying the author through his investigation of this subject, it may be sufficient to say that while his theoretical deductions from certain assumed data cannot be objected to, yet these deductions are certainly at variance with what any practical man would think of adopting. For instance, he ascestains by means of this investigation, that for working a 20 feet embankment at one end only, and for a lead of 150 chains, there should be employed no fewer than 109 horses and 235 wagons, a proposal sufficiently monstrous to startle any one at all acquainted with the nature of earthworks.

The next section is devoted to an examination "of the amount of friction incident upon contractor's rails." The author here establishes that the gross load for a horse on contractors' rails may vary (on a level?) from 5·28 to 7·17 tons, so that knowing the weight of the wagons employed, and deducting this from the gross load mentioned above, we may readily ascertain the number of wagons to be assigned to each horse, provided the quantity of stuff which each wagon is to hold be known, or *vice versa*, the quantity of stuff which each wagon is to carry, according as 1, 2, or 3 wagons are to be drawn by each horse.

The following extract from this section exhibits the author's results derived from an examination of the friction.

"Let P represent the power of a horse, F the friction per ton, upon the load which he draws, and W the weight of a loaded wagon in tons; then it follows, that

$$\frac{P}{F \times W} = X$$

is the load proper for each horse, expressed in wagons; and this value of X has been given in the following table:—

TABLE, GIVING THE LOAD PROPER FOR A SINGE HORSE, EXPRESSED IN WAGONS, ACCORDING TO THE STATE OF THE WEATHER.

Value of F in lb.	Value of W in tons.	Value of P in lb.	Value of $\frac{P}{F \times W}$	Value of X.	State of the weather.	Remarks.
25·45	3·43	188·27	$\frac{188{\cdot}27}{25{\cdot}45 \times 3{\cdot}43}$	2·09	Fine.	Rails in good order.
31·22	3·43	188·27	$\frac{188{\cdot}27}{31{\cdot}22 \times 3{\cdot}43}$	1·75	Fine.	Road wet, and rails greasy.
26·86	3·43	188·27	$\frac{188{\cdot}27}{26{\cdot}06 \times 3{\cdot}43}$	2·04	Fine.	Rails and road in tolerable order.
35·54	3·43	188·27	$\frac{188{\cdot}27}{35{\cdot}54 \times 3{\cdot}43}$	1·54	Wet.	Road and rails in very bad order.

We observe that in several pages of this section the erroneous velocity of 2·40 miles per hour is made use of.

The eighth section contains a summary of those preceding, but as we have already considered these so minutely, it may be unnecessary to remark particularly on the summary.

The remainder of the work is occupied by an investigation into the barrowing system, our notice of which we must defer till next month, and in the mean time we may safely recommend the work to the younger branches of the profession, as exhibiting a very neat, clear, and simple application of algebraical calculation to subjects of practical inquiry.

For the reasons already so fully stated, we cannot advise dependance on the gross results to be derived from the author's mode of calculation, but whenever the student shall either from his own, or the experience of others, have acquired sufficient *data* to found his calculations upon, then the method of handling the subject generally, and particularly of adapting calculations to the practical facts on which they are established, will be found exceedingly useful.

A great deal of useful information may also be gleaned from the observations detailed in the work, and the young engineer in particular, can scarcely fail to have his knowledge of the subject improved by a perusal.

Report of a Proposed Line of Railway from Plymouth to Exeter, over the Forest of Dartmoor. By JAMES M. RENDEL, C.E. Plymouth: Stevens, 1840.

This is a well drawn up report, but we can do no more than call attention to the mode proposed of working the inclines, respecting which we may also mention that a similar plan is described in the First Volume of the Journal.

"From the point of divergence of the Tavistock branch, the main line ascends to Dartmoor; the prevailing gradient being 1 in 38, and the plane 5 miles 860 yards. This part would be worked as one continuous plane, by two water wheels, each equal to 160 horse power, constructed at the head of the plane, and supplied with water as hereafter to be described. The rope to be used for drawing the trains up this plane would be what is technically called an end rope, of the whole length of the plane; being very little longer than the rope similarly used on the London and Blackwall Railway, upon which there is an enormous passenger traffic."

"To insure a supply of water for working the water-wheels before described, by which the trains are to be drawn up the two great inclined planes, at a velocity of not less than from 15 to 20 miles an hour, I propose to throw dams across the gorges of the following valleys on Dartmoor, viz.—across the Blackabrook valley east of the prisons of war, the Cowsick valley above Two Bridges, and the East Dart valley, about three miles north of Post Bridge. These reservoirs would have an area of 255 acres, with an average depth of 20 feet, and contain a sufficient quantity of water, during a continued drought, to pass eight trains per day up the planes, for three months; their height above the wheels is from 50 to 300 feet. The great depth of these reservoirs will cause their supply of water to be independent of the severest known frost; whilst from their height above the Railway, the leats by which the water is conveyed to the wheels, will have so quick a descent as to prevent all chance of the passage of the water being interrupted by either frost or snow. The wheels will work under ground, or rather, in chambers under the Railway, and would not therefore be affected by weather."

The Process of Blasting by Galvanism, addressed to the Highland and Agricultural Association of Scotland. By MARTIN J. ROBERTS, F.R.S.E.

In mentioning that Mr. Roberts has been as successful in Scotland with blasting by Galvanism, as Col. Pasley has been in England, we say enough for the merits of Mr. Roberts. We may farther observe that this small pamphlet contains in addition to a good description of the process, several illustrative plates.

Scott's Practical Cotton Spinner and Manufacturer. By ROBERT SCOTT and WILLIAM SCOTT. Preston: Livesey, 1840.

We are glad to perceive that a useful class of works by practical men are springing up in the manufacturing districts, and likely to prove of great benefit. The book now before us is a collection of calculations applied to the several parts of cotton spinning machinery, adapted equally to the use of the engineer and the manufacturer. It seems indeed to be a most useful work.

A Glossary of Civil Engineering. By S. C. BREES, C. E., &c. London: Tilt, and Weale, 1840.

Mr. Brees seems to have been so successful with his previous works, and rendered so confident by his good reception by the public, that after a very short interval he is again before us. The present work is one of less pretensions than those usual emanating from his pen, being a glossary of the terms used in civil engineering, adapted for popular use, and that of the younger members of the profession, and very useful as a handbook of reference. It is copiously illustrated with woodcuts, some of them of considerable artistic pretension. We should have wished that Mr. Brees had given a little more room for mining terms, of which a manual is much wanted.

The Martyr's Memorial, Oxford. By S. S. SCOTT, and W. B. MOFFATT Architects.

This fine monument is an elevated cross in the pointed style, of majestic proportions, having in the second story statues of the three bishops. The cross is raised upon a series of steps, and we are glad to observe without an iron railing round it. The irregular pinnacles of the church in the back ground are made by the cross to look rather awkward, and should be made more symmetrical—we should suggest, by the gentlemen who have so well fulfilled their previous task.

Ricauti's Rustic Architecture, No. 5. London: Grattan and Gilbert, 1840.

Mr. Ricauti goes on with success in his undertaking, he has shown completely how much beauty may be combined with economy by the simplest means. Even the woodman's axe is an efficient instrument in Mr. Ricauti's hands for giving a picturesque appearance to unbarked trees and small branches. It appears to us that in several of the plans Mr. Ricauti might have greatly promoted the convenience of the arrangements by a few slight alterations.

The Dominican Convent and Chapel at Atherstone, Warwickshire. By JOSEPH HANSOM, Architect.

These buildings were finished in August 1839, and consist of a pile of mixed character in the pointed style. The turret or spire attached to the chapel is a new arrangement of the details of the pointed style, but it appears to us to be rather out of character with the remaining portions.

A Brief Survey of Physical and Fossil Geology. By Frederick John Francis. London: Hatchard, 1839.

This small work is a republication of two lectures delivered at Literary Institutions, and therefore well adapted for popular circulation. The object of such a performance almost places it out of the range of criticism, particularly, whereas in this instance, the work seems carefully compiled.

LITERARY NOTICES.

Mr. **Standish Motte**, the Parliamentary Barrister, has published at the request of the Aborigines Protection Society, a system of registration for the Aborigines of our Colonies, which, although it recommends engineers to be sent out to the colonies, hardly comes within our province; we can say, however, that it contains many profound and original views.

Mr. **Wyld**, the Geographer, in addition to his national work on the Campaigns of the English Armies in the Peninsula, has recently published several authentic Maps and Plans of the Seat of War in the East.

Mr. **Tyas** is about to publish a cheap Map of England in shilling sheets, from the graver of Mr. Jobbins, and on the scale of a third of an inch to a mile. From the specimen it seems likely to prove a useful work.

The new Catalogue of Mr. **Weale** contains the most copious list yet published of works on engineering and architecture.

NOTES OF THE MONTH.

With the rage for promenade concerts, it is scarcely surprising that architecture should have been a little affected with the mania. The Princess's Theatre in Oxford Street, has been opened at present for concerts; it is a gorgeous building in the style of the revival; finished by Mr. Thomas Marsh Nelson; the original design, we believe, being by Mr. Duncan. The ground in Leicester Square, next to the Zoological Society, is being cleared preparatory to a building for promenade concerts.—The Adelphi Theatre has had a new front put on, we believe from the designs of Mr. Beasley. It is a novelty admissible in such a style of decoration, but the pilasters of the lower arch have been unfortunately contracted, from the interference of a neighbour who possesses a right of way.—Oxford Street is being improved by the erection of several new shops on a large scale.—The Architectural Society commenced its proceedings on Tuesday the 3rd.—Mr. Baily has just finished two statues, one of Sir Thomas Brisbane, for New South Wales, and a statue of a distinguished Irish judge for Dublin.—The foundation has been laid of the new Collegiate School at Liverpool.—The British Museum has received several accessions to its Egyptian collections; a fine colossal head has been erected over the doorway, which produces a fine effect.—Considerable stir is being made as to the formation of new railways, but we fear that the Standing Orders will prevent their making much way this Session. Among others we mention, the London and Manchester, the Cambridge and Norwich, through Thetford, the Lincoln and Nottingham, the Devon and Cornwall lines, the Edinburgh lines, one from Mr. Marshall's Slate Quarries to Ulverston.

ON TIDE GAUGES.

Sir—In your October number you have, somewhat incautiously, given insertion to a letter most injurious to my character, signed "James Inglis, London," on the subject of my new Tide Gauge, a description of which was communicated to the Royal Society by the Rev. Professor Whewell, of Cambridge, and printed in their Transactions for 1838.

Divested of those portions of it which, being merely ornamental, may be safely passed over without remark, Mr. Inglis's letter contains an assertion and an implication, to each of which I must give a separate reply. It is *asserted*, that in answer to various letters which I had addressed to Mr. Mitchell, I received from him a description and drawings of his machine, by the aid of which my own was constructed. In reply to this assertion, I beg to state, distinctly and simply, that I never had the slightest correspondence or communication with Mr. Mitchell in my life, either directly or indirectly, and challenge either him or his friend, Mr. Inglis, to produce one scrap or syllable of any letter of mine in evidence of such correspondence. I may also add that I never saw any drawing or description of Mr. Mitchell's tide gauge, and that I have not, at this moment, the least idea of its principle.

The *implication* contained in the letter of Mr. Inglis is, that as my tide gauge was merely a copy taken from that of Mr. Mitchell, with little or no claim either to originality or improvement, it was not only superfluous but unjust that any description of that machine should have been permitted to appear, with my name attached to it, in the Transactions of the Royal Society. On this latter point I cannot do better than transcribe the document itself which was the immediate occasion of my communicating that description to the public. This document was a letter addressed by Major J. B. Jervis, to the Hydrographer to the Admiralty, Captain Beaufort, R.N., and by him enclosed to me, with the following note:—

"*Admiralty, Feb.* 23, 1838.

"My dear Sir—The enclosed note is from the Engineer Officer who has been appointed to succeed the present Surveyor General of India.—Do me the favour to read it, and tell me how far you can assist us, and when.

"Yours very truly,
"F. Beaufort."

(Note enclosed.)

"To Capt. F. Beaufort.—My dear Sir—I rejoice to say that I have found the Court of Directors disposed to give the fullest effect to our wishes in respect of the registry of the Tides, throughout the whole line of coast of India, and wherever their authority extends. I stated my own views to the Chairman, Sir James Carnac, to Mr. Melville, and other influential persons, and fully explained to them that unless the thing were well done, it were far better let alone; whereupon they directed the dispatch and instructions which they had already prepared for the Governor General and Bombay Government to be withheld, and empowered me to arrange with Mr. Whewell, Mr. Lubbock, and yourself, to propose any course of proceeding and measures we thought advisable, and point out the requisite apparatus. With such a magnificent carte blanche, with such superior co-adjutors, it would indeed be a reproach to be either supine or unsuccessful. Mr. Whewell heartily concurred with us on the importance of having the Tides registered with a far greater degree of precision, and at shorter intervals, at several additional points on the shores of India, Arabia, Persia, the Eastern Islands, and China; and was of opinion that at such stations exact meteorological observations should also be made contemporaneously, and these punctually and promptly transmitted home in duplicate every month, to the Admiralty, to the India House, and to the Royal Society. Although Mr. Mitchell's Tide Guage, erected at Sheerness appears to Mr. Whewell to answer sufficiently well for the subordinate stations, he laid great stress on the necessity of something far superior to this, for those stations where it was intended to have more precise and frequent measurements. He spoke to me in terms of high praise, as did also Captain Washington, of Mr. Bunt's apparatus, but said that he much regretted that it had not been published, although he had been in treaty with the inventor to give it to the public with a complete description." ...... "It is the chief object of this epistle to move you to write to Mr. B. to publish his descriptions and drawings. Do let me urge you to use all your influence with him in so good a cause,—and if he would permit a working model to be made under his own eye, it would greatly assist the native artificers of India and expedite the construction of the several tide gauges. The Directors would readily defray the expense of such model.

"Yours, sincerely,
"J. B. Jervis."

In compliance with this earnest solicitation, I immediately prepared and forwarded to Professor Whewell drawings and a description of my tide-gauge, which were soon afterwards inserted in the Transactions of the Royal Society. In doing so, I acted in opposition to the advice of some of my scientific friends, who thought that I was entitled to secure to myself the fruits of so much labour and study. A few months afterwards I was requested to superintend the construction of two machines, similar to my own, for the East India Directors, agreeably to the tenor of Major Jervis's letter, already quoted; with which request I also complied without hesitation. These machines were completed and intrusted to the care of two scientific officers in the Company's service, Lieuts. Elliott and Ludlow; who, after visiting Bristol for the purpose of inspecting my original tide-gauge, sailed with the two new machines for India in February last. From one of these gentlemen (Lieut. Elliott, who had, I think, seen Mr. Mitchell's tide-gauge,) I have received several letters, in all of which he speaks of my machine in terms of the highest commendation.

Immediately on the appearance of Mr. Inglis's letter, I inserted a reply to it in several of the Bristol newspapers, and sent a copy of my reply to Professor Whewell, from whom I received the following note:

"*Trinity College, Cambridge, Oct.* 9, 1840.

"My dear Sir—I have received your slip of the Bristol Standard, and am full of astonishment at the malignant absurdity of Mr. Inglis. Even on his own letter his conduct has this character; for no amount of correspondence with Mr. Mitchell could have deprived your machine of its vast superiority."...... "I am glad you have replied to him so calmly. Captain Beaufort's and Major Jervis's letters must satisfy every body, and do you justice."

I now beg leave to request of you, Mr. Editor, that you will write immediately to Mr. Mitchell, and inquire of him what letters of mine he is able to produce in confirmation of Mr. Inglis's statements; whether he acknowledges any friendship or acquaintance with that gentleman; and whether he will favour you with his precise address: and when you have received Mr. Mitchell's reply, that you will be pleased to communicate it to the public.

I am, Sir, your obedient servant,
Small Street Court, **Thos. G. Bunt.**
Bristol, October 15, 1840.

[In addition to Mr. Bunt's letter, we may ourselves mention that we have written to Mr. Mitchell, and received from him a complete denial that he was ever in correspondence with Mr. Bunt, or that he authorized Mr. Inglis to circulate such statements. In closing this correspondence, therefore, which must be most satisfactory to the claims of Mr. Bunt, we have to express our regret that we should, by the insertion of Mr. Inglis's unfounded charges, have been the means for a moment of raising a doubt as to the originality of Mr. Bunt's invention. We must say that we have never seen a case of grosser or more wicked representation than this by Mr. Inglis, to call it by no other name, and we cannot forbear expressing our severe reprobation of such unwarrantable conduct. We hope that, if he has any feeling of shame about him, he will see the propriety of apologizing as publicly to Mr. Bunt as he has been the means of annoying him.—Editor.]

STATE CAPITOL AT RALEIGH, U.S.

Sir—Under the head of America, at page 52 of the volume of 1837-'8 of your learned work, entitled "*The Civil Engineer and Architect's Journal,*" the *State Capitol* in this city is introduced to the attention of your readers, in an extract of a letter from Ithal Town, Esq., Architect, dated New York, Nov. 3, 1837.

As a Senator, myself, of the State Legislature which ordered its erection, and residing on the spot, I have watched its progress with pride and pleasure, and beg leave to tender to you my thanks and those of my State for even that brief notice of this noble edifice, confessedly unrivalled by any State Capitol in this country. But as I am very sure your readers, and especially artists, would be pleased to see in your Journal a more full and satisfactory description of the building than Mr. Town's letter furnishes, I here copy such a description from the "*Star,*" a weekly newspaper published in this city, and dated 25th March last. It was furnished for publication, at the request of the editor of that periodical, and is known to be from the pen of David Paton, Esq., some years since of Edinburgh, Scotland, the ripe scholar and scientific architect, under whose daily and untiring supervision and direction, for 5¼ years past, this great public work has been executed, and is now nearly completed—a work which entitles him to rank among the first architects, theoretical and practical, of this or any other country, and his private virtues and retiring worth, claim for him universal esteem.

I would not, if I could, detract aught from Mr. Town; his professional fame is the property of my country; but then, "let justice be done, though the hearers should fall." I can not, I will not, conceal the fact, that Mr. Town is mistaken when he supposes that the architectural honour of this fine building belongs to him. It is an honour, indeed, of which any artist might be proud, because it is so perfect and durable a monument of his fine taste and great ability. But this honour belongs to David Paton, Esq., and to none else—and it will wear well, because he has earned it well, and left to others and the work itself, to inscribe his name upon the scroll of fame. Mr. Town did, indeed, furnish a draft for the building, and, likewise, most fortunately for the people of this State, engaged the services of Mr. Paton, 10th Sept., 1834, to execute it; but he is probably unaware that his draught was laid aside, and the whole of the details, alterations, and working drawings, made and executed by Mr. Paton himself. But to the description:—

"The length of the State Capitol in this city, (Raleigh) from north to south, is 160 feet, and from east to west 140 feet; the whole height is 97½ feet. The columns of the east and west porticoes are eight in number, and are 5 ft. 2½ in. in diameter, and 30 feet high, and standing on a stylobate 18 feet high, which, as well as the entablature, which is 12 feet high, are continued round the building; and the details are of the Temple of Minerva, commonly called the Parthenon, which was erected in the Acropolis of Athens, under the government of Pericles, about 500 years before the Christian era. The Rotunda, in the centre of the Capitol, is formed into an octagon at top, which is built of polished granite and surmounts the building, ornamented with Grecian cornice, and its dome is crowned at top with a decoration similar to that of the Lanthern of Demosthenes at Athens.

"The interior of the Capitol is divided into three stories. The basement consists of ten rooms, eight of which will be soon occupied by the Governor, the Secretary of State, the Comptroller, and the Public Treasurer; each having two rooms of the same size and finish, which, as well as the corridors, are of the Roman Doric, and are completely fire-proof, by arches springing from pillars and pilasters of polished granite. The east and west vestibules are richly decorated with granite columns, antæ and staircases; all of polished granite, copied from the Ionic Temple of Ilissus, near Athens; also two committee-rooms.

"The second or principal story consists also of ten rooms, two of which are appropriated, one for the Senate Chnmber, and the other for the Hall of the House of Representatives, which are 38 ft. 6 in. in height, having galleries, and their walls are contained in areas of the same size, 59 ft. by 55½ ft., having retiring rooms taken off the corners, four in the former, and two in the latter. They, as well as the rotunda and vestibules, are respectively of the octagon Tower of Andronicus Cyrrhestes, of the Temples of Erechtheus, Minerva, Polias and Pandrosus, in the Acropolis of Athens, near the Parthenon. The other rooms on this floor are appropriated for committee rooms.

"The third, or attic story, contains a room for the Supreme Court of the State, and one for the State Library, which are situated in the east and west wings; which, as well as the galleries and other apartments, will be approached by granite steps, and the lobbies and Rotunda are lit with cupolas; the whole of which is now in progress, so as to be ready for the next meeting of the Legislature.

"Before concluding, it may be well to remark that the stone with which this edifice is constructed is of the toughest and hardest description, containing less iron than any stone I have ever seen; hence it presents a beautiful cream colour, of a much warmer tint than marble. It is also variegated with beautiful veins of quartz, the conformation of which deserves notice, having every appearance of having been separated and again knit, by some trembling or concussion in its formation; and from the circumstance of no petrifaction being as yet discovered, whether of the animal, vegetable, or mineral kingdoms, geologists would term it a primitive, if not a transition, formation.

With regard to the cost of the Capitol; the Legislature have appropriated 500,300 dollars; it may cost a little more by the time it is finished. The President's house at Washington cost, without furniture, 665,527 dollars; and the Federal Capitol cost 2,596,500 dollars, both of which have to be repeatedly painted, at a cost of upwards of 12,000; and this has to be done to prevent the disintegration of the stone, they being built of soft, loose, friable and porous sandstone.

Architectus."

City of Raleigh, North Carolina,
United States of America. **J. B. Hinton.**
22*nd November* 1839.

RECOVERY OF THE CHAIN CABLE OF HER MAJESTY'S SHIP HOWE, AT SPITHEAD.

The chain cable of the Howe having by an unfortunate accident run entirely out of the hause-hole on Friday morning last, after the anchor was cast, and fallen to the bottom, a creeper was employed to discover it, which grappled it near the buoy over the anchor. On Saturday afternoon, in compliance with a request communicated by one of the lieutenants of the Howe, Colonel Pasley sent a boat to the spot with Mr. George Hall, one of his most expert divers, and a party of men employed about the wreck of the Royal George, to attend him, who threw out a small anchor near the Howe, and then moored their boat in the supposed direction of the chain cable, by making fast a line from the stern of the boat to that cable's buoy. Mr. Hall then descended by the rope attached to the creeper, by which he found the chain, and from that point walked along the whole extent of the chain until he reached the extreme end of it, to the last link of which he made fast one of the bull ropes that had been used for weighing the fragments of the Royal George, by means of which Mr. Purdo, master-attendant of Portsmouth dockyard, and Mr. Taylor, master of the Howe, with a strong party of seamen and marines, got up the end of the chain cable first into a mooring lighter, and in the course of about two hours afterwards it was passed thsough one of the hause-holes of the Howe and properly secured. Mr. Hall went down to the bottom about half-past 2, and finished his task about 4 o'clock, and only came up twice in the mean time, to communicate with the men in the boat. It is supposed that he walked at least 200 yards along the bottom, and during this period the boat with the pump, which was constantly at work to supply him with air, being warped along in the same direction, according to signals made by him from below. This is the second time that this excellent diver has been of use to the navy at Portsmouth, having on a former occasion examined the bottom of the Vanguard after she took the ground on being towed out of harbour by the Echo steamer. As this difficult operation required him repeatedly to pass head foremost under the keel of the Vanguard, he performed it in Mr. Siebe's improved tight diving dress, but in recovering the cable of the Howe, which was comparatively an easy task, he used the common diving dress, in which he has generally worked on the wreck of the Royal George, leaving Siebe's dress to the divers of the Royal Sappers and Miners, who have been employed on the same wreck for the last three months, and whom it was desirable to send down in a tight dress, as being the safest, they not having had any previous experience like the professional divers with whom they have been co-operating.

NEW INVENTIONS AND IMPROVEMENTS.

Improvements in Steam-engines and Steam-boilers; patented by Thomas Craddock, of Broadheath, near Presteign, in the county of Radnor, Sept. 16.—The improvements in steam-engines consist, first, in an improved mode of obtaining a rotary motion from the rectilinear and reciprocating motion of the piston rod; and, second, in an improved method of condensing steam.

The improvements in boilers consist in an improved construction of boiler, and in an improved method of regulating the generation of steam.

First claim is to the mechanical arrangement of the apparatus delineated and described, whether employed for converting the rectilinear into the rotary motion, or the rotary motion into the rectilinear. In this improvement the piston rod carries two toothed racks, one being behind, on one side of the other; one of these toothed racks works into a pinion, which pinion takes into the teeth of a drum, which is firmly keyed on the main shaft, which drum has teeth over half its circumference on one side, and over the remaining half of its circumference on the other side. The mode of working is as follows: by the up-stroke of the piston-rod, the pinion, taking into the teeth on one side of the drum, brings it half round, and is released; then by the returning stroke of the piston-rod, the other rack takes into the teeth on the other side of the drum, and finishes the stroke in the same direction.

Second claim is to the exclusive right of condensing the steam or vapour of water, or other liquids, by causing it to pass into metallic tubes of small diameter, or into metallic vessels of any other suitable figure, which tubes or vessels are put in motion, either rotative or otherwise, either in air or water, independently of any motion of the carriage, boat, or vessel, to which the condenser may be attached, whereby the condensation of the steam or vapour is greatly accelerated. This condenser is composed of two chambers, connected by a bar, and supported by hollow axes revolving in bearings, which axes are connected, the one with the eduction pipe of the engine, the other with a hot well or reservoir. From each chamber a number of hollow arms diverge, which are connected together by small tubes, reaching across several times.

The condensing is performed as follows: the steam, after operating on the piston, is introduced through the chamber into the tubes; the condenser is then caused, by bearings from the engines, to revolve with great rapidity, by which means the caloric is abstracted and the steam condensed; the water resulting from which is conveyed from the other chamber, into which it flows, through a pipe into the hot well; from whence it is drawn by the feed pump into the boiler.

Third claim.—The construction and arrangement of the parts constituting the boiler.

Fourth.—The use of a separate cylinder to supply both air and fuel to the furnaces, and regulating the supply of steam to the cylinder by the pressure of steam in the boiler, in such a manner that as the pressure increases, the supply of steam to the cylinder is diminished, thereby diminishing the supply of air and fuel to the furnace. The boiler is composed of two furnaces, the sides of which are formed of ranges of hollow tubes, which are full of water, communicating at the top and bottom with rectangular reservoirs; the bottom is formed of smaller tubes, extending horizontally from one reservoir to the other, and acting as fire-bars; the top is likewise composed of tubes extending from one reservoir to the other; the ash-pit is a tank filled with water, which, by the heat from the fire-bars, evaporates, and passing up a tube into the condenser, is there condensed; thereby supplying any loss from leakage. The fuel is conveyed into the furnaces by shoots from two hoppers; upon being thrown into the hopper, it falls upon two fluted rollers, which are worked by the pinion that drives the fan; it then falls through or between these rollers, and down the shoot upon a swinging plate, which scatters it over the surface of the fire. The wind passes from the fan through a pipe to the bottom of the fire-bars. When the steam gets beyond the regular working pressure, it shuts the valve which supplies the fan cylinder with steam, and escapes through another opening into the atmosphere, whereby the pinion that works the fan is either stopped, or works very slowly, by which means the supply of air and fuel to the furnaces is very much decreased or cut off altogether; when the steam has returned to the regular working pressure, it is again admitted to the fan cylinder, which works as before. There is a suitable opening, provided with a cover, for the admission of the fire, and likewise a tube with an eye-piece of talc for viewing the fire when required. There is likewise a contrivance for burning the smoke arising from the coals when newly thrown on the fire; it operates in this manner—there is a tube which communicates with the two shoots, and at the bottom of each furnace there is a valve for shutting off the supply of air; when one or both of the furnaces have burnt bright, and fresh fuel is required, the supply of fuel and air is shut off from the other one; the smoke arising from the fresh fuel is driven, by the force of the air from the fan, through the flue into the other furnace, where it passes through the fire and is consumed.—*Inventor's Advocate.*

Improvements in the manufacture of iron and other metals; patented by Sir Josiah John Guest, of the Dowlais Iron Works, Glamorgan, Baronet, and Thomas Evans, of the same place. Sept. 28. These consist principally in the introduction of jets of steam into the puddling furnace while the iron is in the state usually called "fermentation." The success of the operation depends very much on bringing the steam in close contact with the melted iron, to effect which, wrought iron telescope tubes, sliding one on the other, are employed, the jet pipe being ¾ of an inch in diameter, and the steam pressure 15℔. upon the inch. These tubes are raised or lowered according to the quantity of fluid metal in the furnace, by means of a suitable lever. In the second place, jets of damp steam are introduced into the refining furnace, after the pig iron is melted, through the same apertures as the blast, the quantity and pressure of the steam being regulated by the quality of the metal acted upon. During this process, in order to keep the sides, bridge, and bottom of the furnace from burning, a quantity of steam is introduced upon the fluid cinders as soon as the heat is drawn, until the cinders become of the consistence of paste; this paste is then raked up against the back, sides, and bridge of the furnace, so as to fill up any cavity that may have been burned during the previous heat of iron. The use of cinders in this state keeps the iron quite clean and free from the dirt which always attends the use of clay and limestone. In this instance four jet pipes are used, ½ an inch in diameter, and steam of 20℔. on the inch. The steam may be generated in a tube or cylinder in the furnace chimney, or may be supplied from a regular steam boiler. The employment of steam in a similar manner in melting the alloys of copper and iron, and iron and tin, is also claimed, but the particular application is stated to be to the manufacture of iron, whereby a better material is obtained with greater economy. The claim set forth is for the use or application of steam forced upon or into, or in contact with the melted iron in the refining or puddling furnaces for the manufacturing of the same; also for the similar use of steam in the process of melting or manufacturing alloys of copper and iron, and of tin and iron, in such furnaces; and lastly, the application of steam to fluid cinders as described, to produce the paste aforesaid; and the use and application of the said paste.—*Mech. Mag.*

Improvements in preparing surfaces of paper; patented by Henry Martin, o Morton-terrace, Camden Town. Sept. 30. The processes constituting these improvements, are fourfold, viz.: 1. The mode of preparing surfaces of paper by combining thereon a coating of oil paint, with subsequent embossing as afterwards described. 2. The mode of preparing surfaces of paper in the manufacture of paper-hangings, by combining thereon a coating of oil paint, and afterwards printing or producing thereon the required pattern. 3. The mode of preparing surfaces of paper by combining thereon a coating of oil paint, and subsequently glazing or planishing the same. 4. The mode of producing a coating of oil paint on paper, by means of rollers. The paint used for this purpose is the same as ordinarily employed in house painting; a piece of paper of 12 yards, or other required length, is to be laid upon a table of similar dimensions, sized with one or two coats of common or superior size, and then painted with an ordinary brush; while yet wet, the surface is to be smoothed over with a dry brush, to take out the marks left by the first, and subsequently finished with a badger softener, which produces a smooth and level surface, so essential to the success of this process. In the other process, oil colour is laid on the surface of paper by passing it between two rollers, together with an endless felt; this felt in its revolution is supplied with oil colour by passing into a trough, and under a roller partly immersed in the colour; a scraper removes the superfluous colour as it rises, and levels and equalizes the colour; the paper is passed through the rollers two or three times, according to the thickness of colour required. Paper thus prepared on the surface, may be embossed with engraved dies or rollers in the usual manner, or printed with blocks, &c., for paper hangings, which may be washed with soap and water when soiled. If marbled paper is to be produced, the colours are thrown upon water in the usual manner, the effect being increased by softening off before they are dry. If the surface is to be glazed or enamelled, the oil colour is thinned wholly with turpentine, as a flatting colour; when set, it is to be mounted on a woollen cloth, cotton velvet, or other firm soft bed, and smoothed over with a pallette knife, or trowel having a very smooth surface; when dry and hard, the polish may be heightened by any of the usual methods, which will produce a beautiful surface for copper-plate printing, paper hangings, and various other purposes.—*Mech. Mag.*

Valves for Canal Locks; patented in America by William Lake, Richmond, Virginia, June 7, 1839. The patentee remarks, that "the valves of canal locks are subject to a pressure, the intensity of which is measured by the height of the head and the area of the valves; and this pressure on the common sliding-valves for locks of ordinary lifts is of such magnitude, and requires the application of so great a force to open them, as greatly to detract from the superiority which they otherwise possess."

"My improvement consists in giving such form to the valves and apertures that, by the momentary application of a very small force in opening a small orifice, I apply the hydrostatic pressure in such a manner as to open the valves. Upon the back of the valves closing the aperture through which the water flows in filling and discharging the lock, I attach a flanch of the same length as that of the aperture, and of such a width as to have the same proportion to the width of the valves as the friction of the valve on the seat has to the pressure. At the lower edge of the valve, below the flanch, I make an orifice of about one inch in width and about half the length of the valve; this orifice I open and shut by means of a lever and connecting rod."

We were about to make further extracts from the specification, but find that in so doing we must occupy more space than is convenient to allow to the subject; and after all, should probably fail to give a clear idea of the construction without the aid of the drawing; we, therefore, skip over to the concluding paragraph.

"I have represented the valve as fixed in a lock-gate, but I by no means intend to restrict myself in my said improvement to valves placed in this particular situation; neither do I claim as my invent on the manner of applying the lever and screw as exhibited in the drawing. What I do claim as my invention, and desire to secure by letters patent, is the application of the hydrostatic pressure, to open sliding valves for canal and river locks, and making such improvements in the construction of the said valves, and in the form of the apertures to which they are applied, as will adapt them to the application of this pressure, as herein described."—*Franklin Journal.*

RAILWAY CAUTION.

Sir—Being a frequent traveller on railways, and generally choosing the slow trains, I beg leave to trespass on your valuable columns by suggesting an expedient by which, in my humble opinion, travellers situated like myself may avoid the disagreeable necessity of being run over by quicker trains. The plan to which I allude is this:—that at each station on the line of railway be placed a large dial, similar to a clock face, with minutes marked upon it from 1 to 60. It should have one moveable hand of sufficient size to be distinctly visible to the guard and engineer as they fly past; the officer in attendance to fix the hand at that particular number on the dial that may denote the number of minutes which have elapsed since the preceding train passed. This signal might be illuminated at night. Or a perfect clock face might be adopted to denote the hours in addition to the minutes.

I am, Sir,
Your obedient servant,
T. W.

Kennington,
Oct. 24th, 1840.

ROTARY ENGINE.

An engine, upon this principle, was latelytried in Leeds, in the presence of several engineers. Its enormous power, in so small a compass, (the whole machinery, with the exception of the fly-wheel, being contained in a box 2¾ inches in depth and 10 inches diameter) surprised every one present; the speed was tremendous, making from 600 to 700 revolutions per minute. Its power was tested by placing breaks upon the fly-wheel, which was done to the extent that the shaft was actually twisted in two pieces, but no accident occurred. It is the intention of the inventor to apply the machine to propel carriages on common roads, for which purpose it appears admirably adapted; likewise for the purposes of marine navigation, where the small quantity of room it requires is a material consideration; in short, it will answer all the purposes wherein steam is required; and the expense will be considerably abridged. The inventor is Josh. Briggs, watchmaker, of this town.—*Leeds Intelligencer.*

STEAM NAVIGATION.

INCRUSTATION STEAM ENGINE BOILERS.

We are informed by *L'Echo du Monde Savant*, of the 25th of July, that M. Edouard Richard had presented to the Geological Society of France a calcareous incrustation, which must be considered of great value, as it was not formed in the boiler, but in the cylinder of the engine, and beneath the piston. The incrustation formed a disc 12½ centimetres in thickness; and in consequence of the pressure of the piston, it is so hard that it is capable of receiving as high a polish as the densest marble. It is evident, therefore, that explosions may be produced as well by calcareous concretions of the cylinders as of the boilers of steam engines. The engine from which this specimen was procured, has been used for the purpose of pumping water from the mine of Auzin, and has been built after Newcomen's plan.—In *L'Echo du Monde Savant* of August the 5th, we find a communication upon the subject of steam-boiler explosions by M. Flesselle, a retired officer of the French Marine, resident at Graville, near Havre. M. Flesselle suggests, that, in order to prevent the formation of calcareous incrustations, (which have long been considered the principal causes of accident,) some common salt or muriate of potash, should be put into the boiler with each fresh supply of water. M. Flesselle recommends this measure, because the incrustations are formed of the carbonate, the sulphate, and perhaps the phosphate of lime—(salts, insoluble, or sparingly soluble); and these salts, boiled with the muriate of soda (common salt), or muriate of potash, will undergo double decomposition with these muriates; the products being the carbonate, sulphate, and phosphate of soda, and the muriate of lime—salts all of which are soluble.

M. Flesselle says that M. Chaix, of Maurice, has invented a method of preventing explosions, which appears to have been adopted with success in the French government steam vessels; but M. F. considers that auxiliary means also are requisite—and we think he is right; for the fact we have related regarding the engine at Auzin, proves that we should avail ourselves of every cheap and simple aid to prevent the fearful accidents to which incrustations may give rise, seeing that the sulphate, carbonate, and phosphate of lime may be held in suspension by the steam—be carried by it in a state of minute molecular division even into the cylinders—and there also be deposited in the form of hard concretions.—The method of M. Flesselle, seeming founded on correct chemical principles, will, we hope, be put to the test of experience, by some of the numerous engineers of our neighbourhood. We shall feel great pleasure in recording the result.

In England the precaution taken against incrustations is an index of the density of the fluid in the boiler; but this is evidently inadequate—for the calcareous particles are conveyed by the steam into the pipes and cylinder. Perhaps some of our scientific readers will have the goodness to inform us whether the English method of preventing incrustations is identical with that of M. Chaix.—*Gateshead Observer.*

THE PROPELLER STEAM-BOAT.

This vessel was built in the yard of Mr. Dichburn, at Blackwall. The engine by which her paddles, or propellers, as they are termed, are worked, was made by Mr. Beale, the engineer, at his premises at Greenwich. She is a small vessel, but very elegant in her proportions, and formed to cut through the water with great rapidity. The engine is of 24 horse power. The propellers differ from the paddle-wheels used by other steamers, in being single blades of iron, only one blade on each side of the vessel, and not a series of blades brought into the water by the revolution of wheels. Each blade is very broad and large, and dips almost perpendicularly into the water, so that the concussion formed by the blades of paddle-wheels dipping into the water at angles is avoided, and the consequent unpleasant vibration of the vessel. Directly the blade dips into the water it is forced back by an arm or limb of iron, performing a motion similar to the leg and web-foot of an aquatic bird, and by means of this motion the vessel is propelled forward. She can perform from 10 to 11 knots or miles an hour. The appearance of the propellers is like that of the legs of a grasshopper, and when in motion their action in some degree resembles the legs of that insect in its walk. One great advantage is, that the propellers occasion no swell in the water, no wake or trough in the river, and no backwater, so that no danger is occasioned to small boats by the rapidity of her progress. This vessel now runs hourly between Blackwall and Greenwich, and appears to be a great favourite, from the number of passengers she is continually conveying backwards and forwards between those places.—*Times.*

Iron Steamers.—Another iron steam vessel was launched from the yard of Messrs. William Fairbairn and Co., at Millwall, on Tuesday the 27th ult., being the second of three vessels for New South Wales, intended for the trade from Sydney to the Hunter's River. She glided gracefully into the water amid the cheers of a number of spectators, and of nearly 600 men who are employed on the premises, and was named *The Thistle.* She is 145 feet long, 20 feet 6 inches beam, and 11 feet 6 inches depth of hold, about 305 tons burthen, and drew when launched only 3 feet 6 inches of water upon an even keel.—*The Rose*, the first of the trio, has sailed for her destination, and she proved herself before leaving the river to have a speed of 13½ miles per hour, and to be one of the strongest and best sea going vessels afloat. The frames of these vessels were much admired on account of their great strength, as well as the manner in which the whole was put together. The engines, which are of 50 horse power each, were also manufactured, and the whole of the fittings executed by Messrs. Fairbairn and Co., within the same premises. The extent of work which was in progress in the yard, and in the engine manufactory, &c., seemed to surprize many of the gentlemen present, who remembered the place in which these operations are now carried on as a piece of marsh land overflowed by the tide little more than four years ago. Within this period the whole of the extensive workshops and iron foundry have been built. Thirty-one iron vessels, to the amount of 6100 tons have been constructed, and steam engines to the extent of 1260 horse power have been manufactured.—An iron schooner intended for the coasting trade from London, and various steam boats, are now in course of preparation, so that it seems this material is making rapid strides in the public estimation for the purposes of ship building.

War Steamer.—It will be recollected that the steamer of war *Polyphemus*, of 800 tons burthen, was launched at Chatham, on Monday the 28th of September, the same day that the *London* of 92 guns was launched, the former vessel proceeded up on the following Thursday, the 1st of October, to the engineering establishment of the Messrs. Seawards and Capel, of London, and they have completely equipped this fine vessel with engines of 200 horses power, with all her fittings, spare gear, implements and stores, and coal boxes of wrought iron to contain 220 tons of coals, in the short space of 22 working days; being the shortest time upon record that a vessel of this magnitude has been fitted. She proceeded down by steam to Chatham on Wednesday the 28th instant, to take in her masts, being quite completed in her machinery; it is considered that it would require a period of six months in any port of

Great Britain to fit a vessel of war of the same magnitude. There were about 220 men employed by the Messrs. Seawards on the vessel; her engines are upon the same system as those of the "Gorgon, Cyclops, Alecto and Prometheus." The "Polyphemus" will be immediately armed with two 10 inch guns, and will proceed directly to the Mediterranean.

Navigation of the Trent.—An attempt is about to be made to revive the steam navigation of the river Trent. There were packets on the river about twenty years ago, but the extreme shallowness of the water in dry seasons between Nottingham and Newark, frequently interrupted the navigation.—*Hull Advertiser.*

Great Western Steam Ship Company.—We understand that some of the experimentalizing Directors of this Company, have resolved on adopting the Archimedean screw for the great iron ship, and are now reconstructing her at an enormous expense, for that purpose. We need hardly observe, that this course has been adopted without the sanction of the Proprietors.—*Bristol Mirror.*—[How many more changes and whims ?]—Ed. C. E. & A. Journal.

Steamers in the Pacific.—Extract of a letter from Captain Peacock, dated on board the Pacific Steam Navigation Company's steam vessel *Peru*, lat. 9 15 N., long. 25 50 W., out 14 days from Plymouth :—"The *Peru* has hitherto had a most prosperous voyage, answering in every respect my most sanguine expectations."

Calcutta.—A Company has been formed at Calcutta for establishing two steam ferry boats upon the river Hooghly with chains, upon the principle of Mr. Rendel's floating bridges at Plymouth, Portsmouth, and Southampton; and orders have been sent to this country for their purchase. We have great pleasure in stating, that the contractors are Messrs. Acraman, Morgan & Co., of the Bristol iron works; their competitors having been Messrs. Fairbairn, of London, and Messrs. Jawcett and Co., of Liverpool.—*Bristol Mirror.*

Sicily.—On Thursday, the 15th ult., was launched at Mr. Pitcher's yard, at Northfleet, the *Mongibelle*, a vessel of 500 tons burden, for the service of the Steam Navigation Company, for the kingdom of the two Sicilies. It is intended to fit the *Mongibelle* with a pair of Messrs. Maudslay, Sons, and Field's patent double cylinder engines, of the collective power of 200 horses.

America.—Two large steam-ships are building at New York for the Spanish government, and one for the Russian. Mr. Norris, the engine manufacturer of Philadelphia, has received an order from Frankfort-on-the-Oder for 15 of his best locomotives. Thus American ingenuity in steam machinery is prospering.—*Times.*

Canal Steam Navigation.—The experimental steamer, at present on the Forth and Clyde Canal, was lately docked for the purpose of making certain alterations on the propeller. On the former occasion the floats were fixed at an angle of 45 deg. to the shaft of the propeller, which gave, of course, a progressive motion from six feet in each revolution, the diameter of the propeller being two feet. On the present occasion, the floats were placed on the shaft at a more obtuse angle, so as to reduce the progressive motion six to four feet. On Friday week, the boat was got under way from Lock 16. To conduct to a satisfactory conclusion, of course, the pressure of steam in the boiler was made the same as on the first experiments, viz., 54 lb. on the square inch; and the result of this change in the angle of the floats to the shaft, was found to be an acceleration of speed of 20 per cent., or rather more, as compared with the first experiments. That is, when the floats are placed at an angle of 45 deg. upon the shaft, the speed was found to be five miles an hour; now, when the angle was rendered more obtuse so as to produce four feet progressive motion, it was found that the speed was at the rate of six miles an hour. The result was extremely satisfactory to all the gentlemen present, confirming, as it did, their former anticipations; and the boat has again been laid up preparatory to other alterations which are contemplated, in order, experimentally, to demonstrate the most efficient angle at which the floats should be placed upon the propelling shaft.—*Paisley Advertiser.*

Improvement in Ship-building.—The *Roseanna*, a new ship, lately built by Mr. Jackson, at the South Shore, is the first vessel ever entirely fitted with iron lower-deck beams. They are remarkable for their strength and neatness, and above all, give additional room for stowage, equivalent to 12 inches depth of hold. It is by such practical combinations of wood and iron that we may expect to compete with other nations more highly favoured with shipbuilding; and we advise every man who takes an interest in the "wooden walls" to go and judge for himself. The *Roseanna* lies at the south-west corner of the Brunswick Dock.—*Liverpool Albion.*

ENGINEERING WORKS.

New Aqueduct at Dijon.—It is stated in a letter from Dijon, that the experiment made there of the aqueduct which is to conduct the water from the fountain of Rosoir to Dijon, a distance of 12,610 metres (about 13,700 yards) completely succeeded. Crowds of people assembled on the day the aqueduct was to be opened, to wait for the coming of the water, which was three hours and a half in flowing through that distance.—*Inventors' Advocate.*

The Fleet Sewer, Blackfriars Bridge.—A meeting of the City Commissioners of Sewers took place at Guildhall on Tuesday the 13th ult., for the purpose of taking into consideration Mr. Walker's plan of a culvert at the mouth of Fleetditch, adjacent to Blackfriars Bridge, as a remedy for the very great nuisance occasioned by the want of some scientific application. After some discussion in the committee, the Commissioners of Sewers agreed to the adoption of Mr. Walker's plan of the culvert by a majority of about 15 to 3. The apprehensions so generally entertained of the opposition of the Commissioners of Sewers to the enlightened project of the President of the Civil Engineers, are thus very agreeably and permanently removed.

Herefordshire and Gloucestershire Canal—A general meeting of the proprietors of this canal was lately held at Ledbury. The report on the state of the works was very satisfactory, the committee expressing their conviction after a careful survey, that the main part of the line between Ledbury Wharf and Ashberton, upon which the heaviest portion of the works occurred, would be completed within the estimated cost, notwithstanding that the payments for land had been much larger than was expected. The three locks, communicating with the summit level, would be completed before November next, when the trade of the canal would be brought up to the town of Ledbury, from which an immediate increase of traffic was anticipated, and by the end of August, next year, the canal would be opened for the conveyance of goods to the distance of 7½ miles beyond Ledbury, by which extension the trade would, in all probability, be doubled, if not trebled. When it was recollected that the present annual average receipts of the canal, subject as it was to suspension and loss of trade for many months of the year from want of water, was £1,800, the committee anticipated a profitable traffic on the completion of the whole of the works. The estimated expense of the line to Hereford was £76,000, of which sum £45,000 was to be raised by preference shares, and they recommended that the remainder should be obtained by mortgage at five per cent. upon the tolls of the canal. The report concluded by a reference to the completion of the Birmingham and Gloucester Railway, which would open a direct communication with all the large manufacturing towns of the north, and thus operate most beneficially upon the interests of the canal. By the statement of accounts presented to the meeting, it appeared that the receipts amounted to £21,477 5*s.* 5*d.*, and the expenditure to £21,296 3*s.* 4*d.*, leaving a balance in hand of £181 2*s.* 1*d.* Mr. Ballard, the Company's engineer, read a satisfactory report on the state of the works, the leading features of which are embraced in the statement of the committee. The report was unanimously adopted, and a resolution passed for raising the sum of £35,000, in the manner suggested by the committee. Votes of thanks were then passed to the committee (who were re-appointed for the current year) and to the Chairman, after which the meeting separated.—*Midland Counties Herald.*

PROGRESS OF RAILWAYS.

Dublin and Drogheda Railway.—We are happy to announce that the Dublin and Drogheda Railway Company made their first contract on Friday last. The Messrs. Jeff of Lanarkshire were declared the contractors for the part of the line between the Royal Canal and Raheny, on very favourable terms for the Company, and for an amount less than the estimate of Mr. Macneill, the engineer-in-chief. The competition was a very brisk one, there being no fewer than seventeen tenders for the work, and from some of the principal contractors on the great lines in England and Scotland, as well as from some very respectable Irish Companies.—The parties selected have been engaged extensively on the Ballochine Railway, the Monkland and Kirkintilloch Railway, and have just completed a large work to the amount of thirty or forty thousand pounds, on the Wishaw and Coltness Railway in Scotland. Mr. Hart, a contractor on the Great Western Railway at Box, near Bath, made so satisfactory a tender, and so close in amount to that by the Messrs. Jeff, (we hear it was within five pounds,) that the Directors thought it right, with a view of encouraging such competition, to hand him a gratuity of £50, with an assurance that they will be happy to deal with him on a future occasion.—*Dublin Evening Mail.*

Norfolk, Suffolk, and Cambridgeshire Railway.—Considerable exertions are being made in these counties for getting up subscriptions to form a railway to Norwich and Yarmouth, in continuation of the Northern and Eastern Railway from Cambridge. The latter line it is expected will be opened to Bishop Stortford in June next.

West London Railway.—An adjourned general meeting of the proprietors in the West London (late Birmingham, Bristol, and Thames Junction) Railway Company was held in London on the 12th ult., to receive the report of Mr. R. Stephenson, the recently appointed engineer, on the state of the works. The chairman explained that the report of Mr. Stephenson was not yet prepared, but that the secretary would read to the meeting the report of the directors. It stated that it was proposed to make two extensions of the line, one to the Thames, (the original line stopping short of the river by about a mile and a half,) and the other to Knightsbridge; the extensions to be undertaken by a separate company. The directors calculated that £140,000 would be sufficient to accomplish the object, both companies to be amalgamated when the whole of the works were completed, or as soon after the extension company had obtained an act of incorporation as the proprietors of the two bodies might consider fit. The report was unanimously adopted, as was also a series of resolutions in respect to the mode of issuing the new shares for the raising of the additional capital. It was explained that the amount of arrears due upon calls was £14,437. The meeting adjourned to the 14th November, to receive Mr. Stephenson's report.

Opening of the Taff Vale Railway.—The public opening of the completed portion of this interesting and important line, between Cardiff and Navigation House, nine miles from Merthyr, took place on Thursday the 8th ult. The manner in which the works on the line are executed, drew forth frequent expressions of admiration from the party. The tunnel and viaduct at Quaker's Yard are, indeed, noble specimens of engineering skill; the viaduct across the Taff rises to the height of 120 feet, and is built on six massive arches, the masonry of which is in admirable keeping with the character of the surrounding landscape. The tunnel which passes under Godre-y-coed is 500 yards in length; it was brilliantly illuminated for the occasion, and as the company passed through it, preceded by the band, the effect produced by the echoes of its walls and roof, and the glare of upwards of 2,500 lights, was striking and novel in the extreme. The line is differently constructed from the Great Western, the company having, on account of the number of curves which the face of the country rendered necessary, adopted the narrow gauge, and the rails being laid on chairs affixed to transverse sleepers. The travelling is easy, and will safely admit of a speed of from forty to fifty miles per hour. The carriages, which are admirably constructed, were built by our respected fellow-citizen, Mr. Walter Williams, and the two engines at present on the line, the *Taff* and the *Rhondda*, by Messrs. Sharp, Roberts, and Co., of Manchester.—*Bristol Mercury.*

Further Opening of the Manchester and Leeds Railway.—The first portion of this line, which was opened in July, 1839, was a length of about fourteen miles, from Manchester to Littleborough; and on Monday 5th ult., another portion was opened, to the extent of 27½ miles. This portion of the line commences at Hebden Bridge, about nine miles from Littleborough, and terminates at Mormanton, where it joins the North Midland Railway, about fifty miles from Manchester.—*Manchester Guardian.* The *Leeds Mercury*, in noticing the further opening of this line of railway, says,—"We speak on the highest authority when we say, that this railway is the greatest triumph of engineering science over the obstacles interposed by nature, presented by any railway in the kingdom. The high chain of hills which separates the counties of York and Lancaster is only intersected by one valley, namely, the valley of the Calder, and that so narrow and winding, so lined with towns and villages, and so preoccupied by the turnpike road, the river, and the canal, as to make it exceedingly difficult to carry a railway through it. Yet, by embankments and cuttings, by removing rocks and building up arches, by occasionally diverting the river and the road and often crossing both, by piercing the hills with short tunnels, and taking first one side of the valley and then the other, a line has been constructed not only capable of being worked by locomotive engines, but of being easily and advantageously worked. There are no objectionable curves, and there is not one gradient having half the inclination of those on the Liverpool and Manchester Railway. The line is somewhat circuitous, and this is its only disadvantage; a disadvantage which the speed of locomotive travelling reduces to insignificance. The engineer by whom the line was planned, and under whose superintendenc it has been executed, is the celebrated George Stephenson, whose genius and unparalleled works we have so often had occasion to notice with high admiration. Under him Mr. Gooch, one of his pupils, has been employed as resident engi-engineer, and has displayed abilities equal to the execution of the greatest undertakings. The managing director, who has given up his whole time to the superintendence of the work, is Robert Gill, Esq., to whose remarkable energy, zeal, and talent, the company are very greatly indebted for the completion of the work within so short a period."

Birmingham and Gloucester Railway.—The railway from Cheltenham to Gloucester is now completed, or at least one line of rails is permanently laid down through the entire distance, and along these several experimental trips have been made during the past week, wsth the most complete success. The first of these took place on the 17th ult., and the further opening of the line for the public will certainly take place on the day already announced, viz., the 2nd of November.—*Cheltenham Looker-on.*

PUBLIC BUILDINGS, AND IMPROVEMENTS.

ROYAL EXCHANGE.

This building appears at length likely to be commenced; the following tenders for the foundation were received, and that of Mr. Webb accepted.

Webb	8124		
Grimsdale	8738	6	
Cubitt	8984	14	
Little & Son	9423	1	8
Warde	9586	17	
Piper	9979	16	4
Grissell & Peto	10165	5	4
Lee	10387		
Bridger	10627	6	8
Baker & Son	10932	3	4
Bennett	11181	9	6
Winsland	11302	6	8

The New Riding-house and Stabling in Windsor Park.—This extensive building, the expense of which is to be defrayed by the Parliamentary grant of seventy thousand pounds, is now fast approaching towards completion. Some delay has been occasioned in consequence of extensive alterations in the roof of the stabling on the southern side of the riding-house having been suggested by Prince Albert a short time since. The woodwork of the roof of this portion of the building, which was then nearly completed, was observed by his Royal Highness to be discernible (from the interior) through the windows along the top of the south side of the riding-house; and as this was considered to be an "eye-sore," and highly disapproved of the Prince, the building was unroofed and its height reduced upwards of three feet. The riding-house is one of the most extensive in the kingdom; its dimensions being as follows:—height, 38 feet; width, 52 feet; and its length upwards of 170 feet. The frontage of the whole pile facing the Home Park is nearly 300 feet. Numerous bed-rooms for the grooms and stable boys in the service of Her Majesty have been erected over the riding-house. These are of very small dimensions, many of them not being more than ten feet by nine. Their long line of windows extending the whole length of the roof, and discernible from any point a view is obtained of the building, tends considerably to detract from the beauty and general harmony of the structure. Her Majesty and Prince Albert, who have occasionally visited the riding-house and stables during the progress of the works, have expressed themselves much pleased with the economy of the whole of the arrangements.—*Times.*

Improvements on the Exterior of the Mansion-house.—Scaffolding has been erected in front of the Mansion-house by direction of the General Purposes Committee, for the purpose of repairing the dilapidated masonry which has exhibited itself in several parts of the building, which has been vastly improved in appearance by the frequent application of the Bank water engines. The alteration is so great that the walls actually look in some parts as if they were whitewashed. The figures above the pillars, which had been for many years completely hidden under a mass of soot and filth, are now objects of striking interest. As they are in a measure new to the visitors and even the residents in the immediate neighbourhood, we shall briefly describe them. The centre is occupied by a female figure supposed to represent the presiding patroness or genius of the city of London. She holds in her right hand a spear. Her left hand is resting on a shield sculptured with the city arms. She supports a small sculptured castellated tower on head, and is trampling on a recumbent figure, representing her vanquished enemies. On her right hand stands the Roman Lictor and a boy holding the cap of liberty. The extreme right hand angle of the tympanum is occupied by a representation of the superiority of the British empire on the seas by a large reclining figure of Neptune, with his insignia as God of the ocean; and the spaces are filled up with an anchor and cable, &c. On the left of the centre is another female figure, attended by two boys, bearing the olive branch in her right hand, and pouring out abundance from cornucopiæ with her left; the emblems of commerce occupy the extreme angle on the left side, with casks and bales of goods. It has been considered the more necessary to make all practical improvements in the exterior of the Mansion-house, as the new Royal Exchange will much sooner than it is generally expected begin to show itself.—*Times.*

NEW CHURCHES, &c

Boston Wesleyan Centenary Chapel, erected from the design of Mr. Stephen Lewin, architect of Boston, is one hundred feet long, and seventy feet wide between the walls, and is calculated to seat two thousand five hundred persons. The design of the front is Græco Italian; a flight of steps forty-eight feet long, and a colonnade of Ionic columns in antis, and towers at each end, in which are constructed the grand staircases that communicate with the gallery, having steps five feet long, and landings at each angle five feet square; above the staircase are rooms appropriated to the Wesleyan service. There are two main entrances to the body of the chapel through spacious lobbies, with jib doors communicating with the aisles. The ground floor of the chapel contains three divisions of pews, and the sides are provided with free sittings, on each side of the communion is occupied by the schools; the pulpit is approached by two flights of stairs, at the back of the pulpit are vestries with private entrances to the same. The ceiling is forty feet high from the ground floor, it is panneled with ornamented ventilators at the angles, and a block cornice with panneled pilasters round the gallery, uniform with pannels of ceiling; the divisions and doors of the pews, &c., next the aisles are made of wainscot, framed and moulded; the orchestra is formed at the back of the gallery with private stairs and room for the singers.—The building and ground will cost upwards of eight thousand pounds.

St. Michael's Church, Basingstoke.—Extensive alterations are being made in this edifice, which is a fine specimen of the style of Parochial Church of the reign of Henry 6th. It is being entirely repaired and provided with new galleries, &c. to accommodate fifteen hundred persons. The fittings throughout will be of wainscot. The estimated expense is upwards of two thousand pounds, which has been raised by a liberal subscription in the town and neighbourhood, with the Societies for church extension. Mr. J. B. Clacy, of Reading, is the architect. The church is also undergoing extensive repairs, estimated at fourteen hundred pounds, to effect which a vestry last week empowered the churchwardens to borrow one thousand pounds, in addition to a previous rate of about five hundred pounds. This is an example worthy of imitation by other parishes, where, from a false economy, memorials of ancient ecclesiastical architecture are fast mouldering to decay.

Birmingham.—The ceremony of consecrating the church of St. Mathew, at Ashted, the first of the proposed ten new churches to be erected in the town, took place on the 20th ult., it is a spacious and commodious building of early decorated Gothic architecture, built of brick, with dressings to the windows, doors, &c. of Wedley Castle red stone, and also a spire of the same stone. It contains about one thousand and fifty sittings, including four hundred free seats, without side galleries. It was designed by Mr. Thomas, the architect of Leamington, who very handsom[illegible] presented a window of stained glass.

Wolverhampton.—The ceremony of laying the first stone of St. Mary's Church, which, with the parsonage house and school attached, will be erected at the sole expense of Miss Hinckes, of Tettenhall, took place in the presence of a very numerous concourse of spectators, on Thursday last. The endowment, which it is understood will ultimately amount to three hundred pounds, and the site, are also the gift of the same benevolent lady; the total cost of the building is estimated at ten thousand pounds.—*Midland Counties Herald.*

Great Haywood.—The consecration of St. Stephen's Chapel, recently erected on a beautiful site given for the purpose by the Earl of Lichfield, in the parish of Colwich, took place last month. It is of very beautiful construction, and reflects great credit on the taste and ability of Mr. T. Trubshaw, by whom ti was designed.—*Staffordshire Gazette.*

MISCELLANEA.

New mode of hanging Pictures.—A very clever and useful invention for the above purpose has been lately patented by Mr. W. Potts, of King William Street, Strand, which we think, as it becomes known, cannot fail of being patronised by all collectors of pictures. The methods of hanging pictures commonly in use are by driving nails into the walls, or running iron or brass rods round the room. Both are objectionable, the former as it damages the decorations, and the latter not only destroying the architectural effect of a well-proportioned apartment, but also that the brackets which support the rod prevent the hooks or cords from sliding to any part wanted. In the patent plan, the means of fixing being above the hooks, they can be moved all round the room with the greatest facility, and necessarily saves much time in hanging or arranging a collection, particularly when any addition is made to it. Attached to the invention are moveable pendant chains and rods, with cross bars and shifting buttons or studs, which can be used or not at the pleasure of the party. Another and very great advantage connected with the plan is, that the rail combines a cornice moulding with the means of supporting pictures, and can be made to form the bottom member of the entablature, as the line in front is not touched either by the hooks, chains, or cord. We cannot but recommend the plan to the notice of architects, as well as to the artist and amateur, as an invention deserving their attention and adoption.

Mr. Junius Smith.—The American papers mention that the degree of LL.D. has been conferred by the University authorities on Mr. Junius Smith, of London, the gentleman whose enterprise, science, and perseverance, have so eminently contributed to the establishment of steam navigation between the old and the new worlds.—*Morning Post.*

Experiment of Large Guns.—On Friday, 11th ult., a party of the Royal Artillery, commanded by Major Chalmers, proceeded to the proof butt in the Royal Arsenal, Woolwich, at 1 o'clock p.m., for the purpose of trying a plan which has been some time in operation in France, for discharging large pieces of ordnance by a hammer and detonating powder, the present system in the British army being with a portfire, ignited and kept burning until the word of command is given. Sir John May, Colonel Dundas, and Colonel Dancey attended to witness the experiment. The gun selected was a 32-pounder, and the charge each time was 10 lb. of powder in a flannel cartridge, with a 32lb. ball fitted in a wooden cup made flat at the end next the powder. Forty rounds were fired, and the simplicity and certainty with which they were discharged gave great satisfaction. The invention is so simple, and might be so easily applied, that there is every reason to believe it will be universally adopted in the Ordnance department. It consists of a small hammer, with a handle about six inches in length, the whole made of brass, acting in holes made in two small pieces of steel fixed by screws to the right side of the gun. The action is given by pulling a piece of cord six feet long, when the hammer falls on the vent charged with detonating powder with such force as to cause instant and certain ignition. There is a small piece of steel to cover the detonating powder, that it may not become wet in rainy weather, and this is so contrived that it falls back the moment the hammer begins to descend.

The New Town of Fleetwood-on-Wyre.—Three years ago there were only two houses at Fleetwood, and the site of the town was a barren waste overrun with rabbits; now there are 103 houses inhabited to overflowing, and 54 in course of erection. It is said that a considerable quantity of land is purchased for building upon, but there is considerable difficulty in procuring a sufficient supply of brick, stone, and lime, consequently building operations are considerably retarded. We may mention, however, that a small but neat church, capable of accommodating about 400 persons is reared, and that the two shore lighthouses, which will be lighted with gas, are in a forward state, one being about 60 feet high, and the other about 12. As the designs are chaste and beautiful, they will be highly attractive objects to strangers visiting the district. A portion of the iron pier head is completed, and the remainder is in a forward state. There will be a shade erected on the pier for the purpose of keeping the goods, as they are landed, dry, and a line of railway will be laid along the pier, with suitable cranes for the landing of heavy goods; and it is probable that these works will, in the course of a month or six weeks, be so far complete as to enable the Company to commence the carrying trade on a great scale, when a considerable increase of trade to the port may reasonably be expected.

French Steam Engine Factory.—The *Armoricain* of Brest, in giving an account of the Government steam-engine manufactory of Indret, says in its present condition it can only turn out three engines of 160 to 220 horse power per annum, but that Government wishes to increase it, so as to enable it to make annually 12 engines of 450 horse power each. The sum allotted to this establishment last year by Government was 700,000f., but it has now been carried up to 2,000,000f. Six slips for building steamers are attached to the establishment; and a war-steamer, the *Gassendi*, of 220 horse power, is at present building here.—*Galignani's Messenger.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 1ST OCTOBER TO 22ND OCTOBER, 1840.

Frederick Payne Mackelcan, of Birmingham, for "*certain improved thrashing machinery, a portion of which may be used as a means of transmitting power to other machinery.*"—Sealed October 1, six months for enrolment.

Thomas Joyce, of Manchester, Ironmonger, for "*a certain article which forms or may be used as a handsome nob for parlour and other doors, bell pulls, and curtain pins, and is also capable of being used for a variety of useful and ornamental purposes in the interior of dwelling houses and other places.*"—October 1; six months.

William Henry Fox Talbot, of Lacock Abbey, Esquire, for "*improvements in producing or obtaining motive power.*"—October 1; six months.

William Horsfall, of Manchester, Card Maker, for "*an improvement or improvements in cards for carding cotton, wool, silk, flax, and other fibrous substances.*"—October 1; six months.

James Stirling, of Dundee, Engineer, and Robert Stirilng, of Galsten, Ayrshire, Doctor of Divinity, for "*certain improvements in air-engines.*"—October 1; six months.

George Richie, of Gracechurch Street, and Edward Bowra, of the same place, Manufacturers, for "*improvements in the manufacture of boas, muffs, cuffs, flounces, and tippets.*"—October 1; six months.

James Fitt, Senior, of Wilmer Gardens, Hoxton Old Town, Manufacturer, for "*a novel construction of machinery for communicating mechanical power.*" October 7; six months.

John Davies, of Manchester, Civil Engineer, for "*certain improvements in machinery or apparatus for weaving.*" Communicated by a foreigner residing abroad.—October 7 six months.

Thomas Spencer, of Liverpool, Carver and Gilder, and John Wilson, of the same place, Lecturer on Chemistry, for "*certain improvements in the process of engraving on metals by means of voltaic electricity.*"—October 7; six months.

Thomas Wood, the younger, of Wandsworth Road, Clapham, Gentleman, for "*improvements in paving streets, roads, bridges, squares, paths, and such like ways.*"—October 7; six months.

Charles Payne, of South Lambeth, Gentleman, for "*improvements in salting animal matters.*"—October 13; six months.

Robert Pettit, of Woodhouse Place, Stepney Green, Gentleman, for "*improvements in railroads, and in the carriages and wheels employed thereon.*"—October 15; six months.

Henry George Francis Earl, of Ducie, Woodchester Park, Gloucester, Richard Clyburn, of Uley, Engineer, and Edwin Budding, of Dursley, Engineer, for "*certain improvements in machinery for cutting vegetable and other substances.*"—October 15; six months.

William Newton, of Chancery Lane, Civil Engineer, for "*certain improvements in engines, to be worked by air or other gases.*"—October 15; six months.

James Hancock, of Sidney Square, Mile End, Civil Engineer, for "*an improved method of raising water and other fluids.*"—October 15; six months.

Henry Pinkus, of Panton Square, Middlesex, Esquire, for "*an improved method of combining and applying materials applicable to formation or construction of roads or ways.*"—October 15; six months.

Charles Parker, of Darlington, Durham, Flax Spinner, for "*improvements in looms for weaving linen and other fabrics, to be worked by hand, steam, water, or any other motive power.*"—October 22; six months.

Richard Edmunds, of Banbury, Oxford, Gentleman, for "*certain improvements in machines or apparatus for preparing and drilling land, and for depositing seeds or manure therein.*"—October 22; six months.

Thomas Clark, of Wolverhampton, Ironfounder, for "*certain improvements in the construction of locks, latches, and such like fastenings, applicable for securing doors, gates, window shutters, and such like purposes.*" Communicated from a foreigner residing abroad.—October 22; six months.

Gabriel Riddle, of Paternoster Row, Stationer, and Thomas Piper, of Bishopsgate Street, Builder, for "*a certain improvement or improvements on wheels for carriages,*" for the term of seven years, being an extension of former letters patent granted to Theodore Jones, of Coleman Street, and by him assigned to the said Gabriel Riddle and Thomas Piper.—October 22.

TO CORRESPONDENTS.

R. *We have some suspicion that the Propeller is not new; we will inquire respecting its originality.*

Robertus. *We have not space for the communication he has favoured us with, containing a list of the "Queen's subjects" whose trades are connected with British shipping.*

Ω *We will take advantage of his communication at some future opportunity.*

S. L. *Designs of a Wesleyan Centenary Chapel were received last month.*

Mr. Kingsford's *plan for a Harbour of Refuge at Dover, we are compelled to omit for the present.*

A Constant Reader. *We cannot inform him.*

Architectus. *His communication from America will appear in the next Journal.*

Book received:—Science of Vision.

We have been obliged to defer until next month the Plan and Section of the Reform Club, *in consequence of the artist not being able to complete them in time.*

The next number for December will complete the Third Volume, and will contain the Title, Preface, and Index. Subscribers are requested to complete their sets of the Journal.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD PRICE 17s.

⁂ THE SECOND VOLUME MAY ALSO BE HAD, PRICE 20s.

DIRCKS' PATENT IMPROVED METALLIC RAILWAY WHEEL WITH WOOD-FACED TYRE.

Fig. 1.

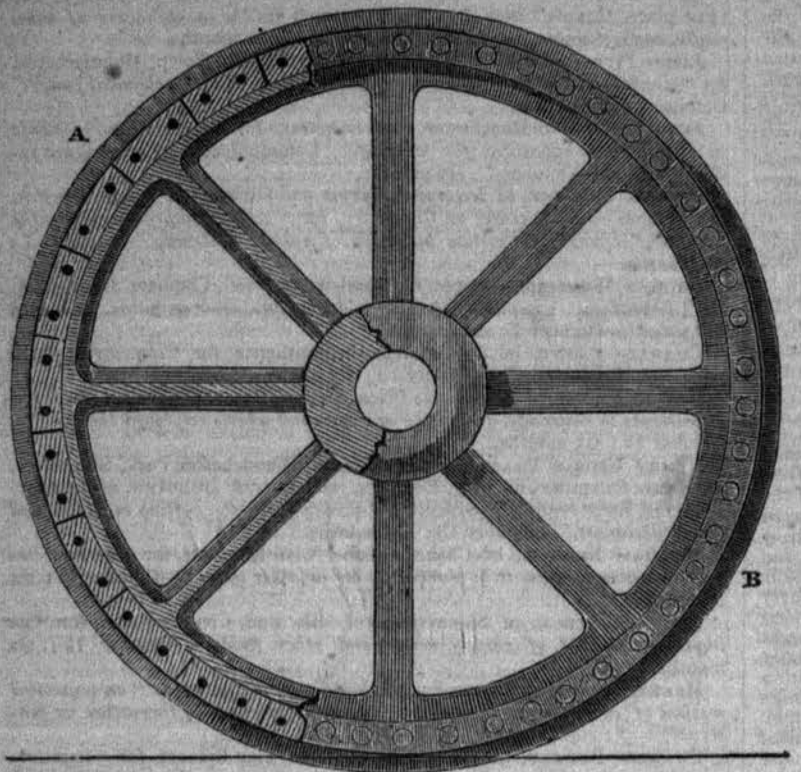

Fig. 2.

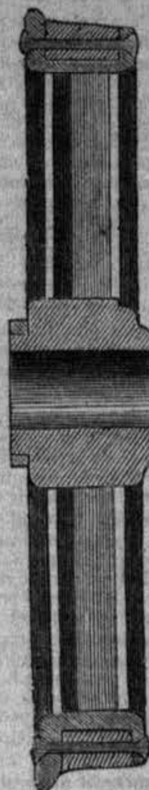

Fig. 3.

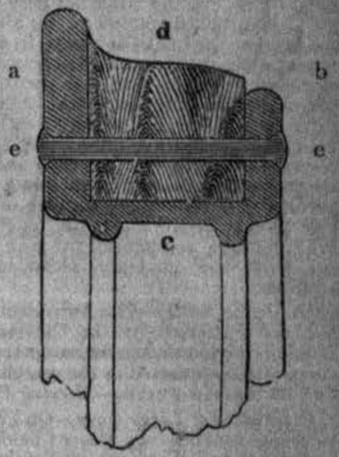

Fig. 4.

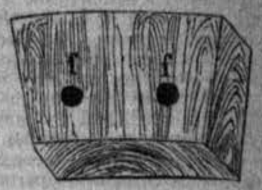

Fig. 5.

Description.

Fig. 1, represents the wheel, half in section, as at A, and half complete, as at B; the view being a front elevation.
Fig. 2, edge elevation, in section.
Fig. 3, showing the channelled tyre *abc*, with the wood inserted at *d*, fastened by the pin or rivet *ee*.
Fig. 4, represents one of the wooden blocks in perspective, perforated with two holes, *ff*, for receiving the pins or rivets.
Fig. 5, cross section of arm of wheel.

Read by Mr. Henry Dircks, before the Mechanical Section of the British Association, at Glasgow, Sept. 19, 1840. *And also before the Polytechnic Society at Liverpool, Oct.* 8, 1840.

As an introduction to the observations immediately relating to the improved wheel which is the subject of the present communication, a few preliminary observations may serve to make its nature and advantages more generally understood.

Wooden wheels were originally in common use on railways; these were afterwards superseded by the extensive use of cast-iron wheels; and both of these descriptions of wheels were much improved by manufacturing them with wrought iron tyres. Modifications of these wheels are still in use on the Liverpool and Manchester Railway, the wooden wheels having the nave of cast iron, and the spokes and rim of wood, the tyre being of wrought iron. On the London and Birmingham Railway, cast iron wheels are extensively used. On the continent of Europe, and in America, cast iron wheels are seemingly employed by preference; and are no doubt quite as safe for travelling, where great speed is not practised.

In England, a decided preference is given to wrought iron wheels, in which this metal is used throughout, with the exception of the boss being *cast* around the ends of the spokes. The latest improvement on these has been the making of the entire wheel, including the boss, of wrought iron.

The wheels now in general use derive their chief novelty from the construction and placement of the spokes, with a view to obtain elasticity, strength, and durability. One variety which does not come under this denomination, is the plate wheel, supposed on its introduction to possess some peculiar advantage in overcoming a supposed resistance of the atmosphere. Except, however, in relation to variations in size, the present wheels are little more than varieties in pattern. The common diameter of carriage and waggon wheels is three feet, and the largest driving-wheels for locomotives are those employed on the Great Western Railway, being six to seven feet in diameter,—though at one time they were made as large as ten feet.

The action of an iron wheel on an iron rail, though derived from a rolling motion, can only be compared to a series of blows, and the rebound occasioned by iron striking iron is well known to be considerably greater than is produced by striking wood on iron. To this simple fact we may trace the tremulous motion occasioned by iron wheels on an iron railroad; and when, by any trifling accident, as an inequality from the rising of one end of a rail, or sometimes even from small flinty pebbles getting on the rail, the rebound is not more fearful than dangerous. The tremulous motion of the rail just adverted to renders it necessary in most cases to lay the rails on wooden sleepers. As an illustration of what is meant, it may be mentioned that on the Dublin and Kingstown Railway the rails were originally laid on granite sleepers, but the tremor was so great as to loosen the rails, and occasion serious fears from the consequent damage sustained by engines and carriages passing along the line. It was, therefore, ultimately agreed to take up the granite and lay down longitudinal wooden sleepers, a work of considerable labour and expense. In some cases the nature of the soil or sub-soil may allow the use of stone blocks; and where they can be applied with safety, they are preferred, for the reason that a road laid on *stone* blocks can be kept up at a lower rate than one laid on *wooden* sleepers; and, as has been endeavoured to be clearly shown, the only reason for laying the stone aside, arises from the tremor imparted to the rail by iron wheels as at present used. Brees, in his Railway Practice (1839), gives, in a copy of an estimate for work on the "North Union Railway," the following particulars, at page 142:—

Maintaining railway crossings and sidings, when laid on stone blocks of five cubic feet, for the first year, per mile		£150 0 0
Ditto ditto second year . . .		80 0 0
		£230 0 0
Ditto, on larch sleepers, for the first year, per mile	£200 0 0	
Ditto ditto second year	120 0 0	
		£320 0 0

We shall now proceed to a description of the improved metallic wheel with wood-faced tyre, showing its advantages in connexion with the preceding observations. The construction of the wheel may be undarstood by imagining a spoked wheel with a deep channelled tyre. The wheel may be made either of cast or wrought iron, it having been ascertained that tyre bars can be rolled to the required pattern. In this channelled tyre are inserted blocks of African oak, measuring about four inches by three and a half inches, solidified by filling the pores with unctuous preparations; thereby counteracting the effects of wet by capillary attraction,—to which, by this means, it becomes impervious, and at the same time is not liable to unequal contraction and expansion. The blocks of wood are cut to the requisite form to fit very exactly in the external circular channel of the wheel, with the grain placed vertically throughout, forming a complete facing of wood, as shown in the engraving. There are about from twenty-eight to thirty of these blocks round each wheel, where they are retained in their place by one or two bolts passing through each, the two sides of the channel having corresponding holes drilled through them for this purpose: the bolts are then well rivetted. After being so fitted, the wheel is turned in the usual manner. The wheel when finished has all the appearance of a common railway wheel, but with a rather deeper rim, the tyre faced with wood, and the flarge of iron. Woods of various qualities may be used, whether hard or soft, requiring different chemical preparations according to their porosity, and in some instances requiring to be compressed.

The several advantages which this wheel possesses, are—

1. That the wood facing will wear a considerable time without requiring any repair.

2. That the wood can be refaced, by turning it up again in the lathe, as practised with worn iron tyres.

3. That the tyre can be re-faced with wood at little expense, and at a far less loss of time than usual. In the operations of re-facing these wheels, or putting in new wood, the work can be performed without the labour and cost of removing the wheels from the axles, which in the keying and unkeying is known to be very troublesome.*

4. That, in regard to their working, it is the opinion of practical engineers, confirmed by actual experiment, that they will work smoother, easier, and, as some have expressed it, more "sweetly" than iron-tyred wheels; with the advantage of going well in wet weather, even upon inclines,—having sufficient adhesion to the rail, without dropping sand to assist them in this respect, as practised when iron wheels are used.

5. That another and very important result will be, that the rails themselves will suffer less wear by using this kind of wheel, and that the fastenings, sleepers, and blocks will receive considerably less injury, and thereby favour the laying of railroads on stone blocks, wherever they are considered to be most desirable.†

A metallic wheel with a wood-faced tyre, which is the principle of this construction, obviates most, if not all, the difficulties which have been experienced, whether in the use of wooden, cast iron, or even wrought iron wheels. Cast iron wheels may, indeed, now be considered not far short of being equal to wrought iron wheels, for safety and durability, with all the superiority of which the application is susceptible. They are also neither clumsy nor inelegant in form, and are capable of being made to any pattern, even for carriage wheels for common roads. It may, therefore, very possibly occur that they will have the effect to bring cast iron wheels into as general use, and as much reputation here as on the continent. This new construction and simple adoption of wood makes excellent driving wheels for locomotives; it may be readily stopped by using a cast iron break, and does not undergo that wear which might be expected from the friction it then has on the rail. The wood, by use, becomes exceedingly close and firm, acquiring a surface not easily distinguishable from metal in appearance.

These wheels are manufactured by Messrs. Brocklehurst, Dircks, and Nelson, millwrights, engineers, and iron-founders, at their works, No. 12, Oil Street, Liverpool; where they may at any time be seen.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XX.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. After "*But*," the most provoking word in the language is your "Only"; which is employed extenuatingly to apologize away, as it were, the very sum of complaint, as being a mere trifle, too insignificant to be taken into the general account. This or that building may have *only* such or such defect, and of course you run the risk of being set down for a very ill-natured, or an exceedingly fastidious hypercritical sort of person, if you object to it on such account, even though it should be of such nature as absolutely to cancel all other merits and recommendations. There are cases in which a single defect may be a fatal one; I might instance this directly and architecturally by referring to buildings which furnish cases in point; but it may be illustrated by the anecdote related somewhere, if I mistake not, by Theodore Hook, of the Adonis who had only a single blemish. In every other respect his person and countenance were unexceptionable. His mouth, teeth, hair, eyes, hands, were all allowed to be perfect, and were expatiated upon by a friend so eloquently that a lady fell in love with his description, and desired that the original might be introduced to her; on which the other thought fit to hint that he had omitted one slight imperfection in the portrait he had drawn, but it was "only a single blemish," a mere trifle, absolutely, in comparison with the loss of an arm or a leg. "Oh! some scar, I suppose—perhaps a wart?" inquired the lady; "an unlucky wart, perhaps, on the tip of his nose." "A wart on tip of his nose! Bless your heart, no! for the truth is, he has—*no nose at all!* which little defect is the one I alluded to."

II. It is precisely such "little defects" and slight blemishes that mar so many buildings and works of architecture. They have—in description at least—a host of merits; columns *comme il faut*, Doric or Corinthian, unexceptionable proportions, amplitude of dimensions, solidity of materials, &c., are expatiated upon till you raise your expectations almost to the highest pitch. At length you discover that the "slight defect"—the "only fault"—should any have been hinted at, renders the anticipated piece of perfection very much in the same plight as the Adonis with the single blemish—the Adonis without a nose.

III. When people begin to be sick of the everlasting boring and twaddling about styles, they will then, perhaps, begin to find out that quite as much or more depends upon the application of a style, as upon its merits as such. For what are the different styles of architecture, but so many different languages of the art—some of them more perfect, more expressive than others; but the excellence of a language, and the excellence of a composition in it, are quite distinct matters. The same language may be the vehicle of wit or of stupidity; and so also may the same style of architecture be employed tastefully or uncouthly; by one so as to charm and delight, by another so as to excite only ridicule and disgust. Which being the case, of what practical value are all those superficial, vague, and wearisome discussions from time to time on the subject of styles, in which not a single idea is brought forward that has not been repeated times innumerable before? On no other subject would such mere school-boy stuff be endured, much less pass for any show of learning, as is *parroted* in regard to architecture. Many prate most glibly about the age of Pericles; yet ask one of those erudite, sagacious gentlemen, what he thinks of that age in its chryseo-elephantine works, and architectural polychromy, and ten to one but he will be struck all of a heap; he wonders what *elephants* have to do with the matter, nor did he know before that Pericles had a daughter named *Polly*.

IV. The fact is, we are apt to judge of styles as we do of national or of professional character—in the lump; which, though a most expeditious and convenient, save-trouble mode, not unfrequently leads into dreadful blunders. The French are a lively people, yet shall you find Frenchmen of most excessive dulness and stupidity. You may stumble upon honesty in the shape of a lawyer, on temperance in that of an alderman, and on perfect good-nature in the person of a sarcastic satirist.

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* As in every thing affecting railways, it is a desideratum to decrease the expense as much as possible, it may here be mentioned that three feet cast iron wheels, with wood-faced tyres and wrought iron axles complete, can be made much cheaper than the generality of wheels.

† On lines situated like the Greenwich Railway and the Blackwall Railway, wood faced wheels would diminish much of the noise which at present is a source of general complaint.

V. In an article in the Gardener's Magazine for November occurs the following bit of architectural comment: "in returning we observed two frightful chapels; the Hanover Chapel at Peckham, in the form of a pentagon, with small mean windows without facings, and red brick walls without cornices or any decoration whatever: and another chapel nearer Camberwell, of larger size, with similar walls. and *three or four stories* of naked windows like those of a third-rate dwelling-house! Chapels in general, throughout the country, are at present *a disgrace* to it, in an architectural point of view; but it is to be hoped that the spread of knowledge and taste will raise them to a par with other religious buildings." Yes, our chapels—and *churches*, too—generally are a disgrace to the country, as well on account of the beggarly, shabby, sordid meanness, as for the execrably bad taste they display. But as for the good taste that is to lead to a better system of things, where is it to come from? Certainly not from the fountain head—not from the Church Commissioners. However, I will not be quite sure that even brick boxes, with three or four stories of sash windows, are not a degree more endurable than those most trumpery *Gothicisings* or *Grecianizings*, as the case may be, which spring up like mushrooms in the purlieus of Islington, &c., and whose scanty pauper finery forms a contrast no less ludicrous than woful, with the bareness of their posterior parts. Economy is excellent, but the economy which treats itself with a smart shirt front, while it denies itself a pair of breeches, cannot possibly be extolled for its nice attention to decency.

VI. If I am rightly informed, more than one of the Islingtonian buildings alluded to is the joint production of two architects, in which case, to judge from the littleness of their united taste, the taste of each singly must be exceedingly little indeed. Or, would not the rather stale anecdote of the two helpmates come in here most pat? "What are you doing, Jack?" "Nothing, sir." "And Tom, what are you doing there?" "Please, sir, I'm just helping Jack." It was undoubtedly after some such fashion that the Messrs. Tom and Jack there employed *assisted* each other in providing taste for the Islingtonians. Certain it is that taste fares no better among Church Commissioners than among their worships the Churchwardens.

ON THE ORIGIN OF ALPHABETIC WRITING ON MONUMENTS, TOMBS, &c., IN ANCIENT GREECE.

Amongst the many pleasures connected with historic research, may be recorded that which the antiquary feels, as the evidences of some lost truth unfold themselves to his eye. To find how link after link completes the chain, or how the past is restored to observation after a lapse of centuries, is no less interesting, however, to the architect, the painter, and the sculptor, whenever the purposes of art are assisted by such a discovery. With this preface of apology for discussing the present subject, I humbly offer my opinions, with the unpretending wish only, that it may lead to a deeper attention from others. My idea of handling the theme arose from a remark of Canina's upon some ancient tombs found at Cœre, (now Cervetri, or Ceveteri). His remark is embodied in a paper, read at the Institute on the 30th March, 1840. He concludes from the peculiar form of the Greek characters of the inscriptions, that the tomb must have been erected before the Trojan war. Now the Trojan war is an event—an epoch in history. It encompasses within it a variety of interesting facts, customs, manners and rites. To determine the existence of alphabetic writing, as existing on monuments and tombs, before or after that period, is no less interesting; especially as in the investigation we trample on the memory of the honoured dead; for whom art has done and expected so much, and for whose deeds and memorable acts, genius has prepared such monuments of beauty and of skill.

Canina evidently presumes alphabetic writing as common to the tombs of the great before the Trojan war. With submission then to his opinion, as well as to others, who I know agree with him, I will assume the contrary, and endeavour to prove it of a later period.

First, I rely greatly on the authority of Homer, on the minuteness, care, and correctness of that poet, on his punctilious observance of customs, and on the extreme finish of his descriptions. Assuming this, I turn to the tale of Βελλεροφον (Iliad 6th, 168), not to disprove the non-existence of letters, &c., but to reveal Wolfius a German commentator upon Homer, guilty of the same idea as myself, since upon that tale, he presumes alphabetic writing unknown in the heroic ages. Secondly, our introduction to Patroclus's tomb, has no mention of any inscription, or written memorial. Thirdly, that the word γραφειν of such frequent occurrence, according to Guoquet, "ne signifie jamais chez Homer que representer oû decrire un objet." Fourthly, that wherever commands are given, or messages sent, they are done verbally; and whenever a treaty is ratified, it is done by sacrifice, or oath. Then again, Virgil's careful picture of Misenus's death and burial, and of the tomb erected, &c., mentions no inscription, which strengthens the argument, when we consider that Enœas is trying to pacify the spirit of that hero in the infernal regions, with a minute detail of all the honours and tributes paid to his memory. To omit one observance, would display a carelessness totally at variance with an otherwise ingenious recital.

Besides no nation was ever more jealous than the Greeks of funeral honours. The advantages of an illustrious victory were often neglected to perform this duty. Victorious generals were sacrified for want of zeal in burying the soldiers slain in battle; whilst the auguries they derived from, and the vows they made over tombs, evince with what earnestness, the depositaries of the precepts of religion, had ever recommended the duties of the sepulchre. But perhaps it may be said that Guoquet in his work "sur les origines des lois, des sciences et des arts," admits the existence of alphabetic writing in Greece before the Trojan war. If so, let it be remembered, he adds, "that it was less practised." Besides if Guoquet were correct in his supposition, the knowledge of letters as a medium of conveying thoughts through the body of the people, must necessarily prove tardy and progressive. And although we believe it in existence at the time of Cadmus, still a natural inference would be, that the priests, as in ancient Egypt, were for a long time alone familiar with the written or descriptive language. The fact, too, that the Mexicans and Peruvians had attained to a great degree of civilization, without the use of letters, may assist such an idea.

The question then naturally arises, how, if inscriptions be to memoralize worth, or to record virtue, and how, if the knowledge of letters be assumed as slight, partial and confined, could the object be effected; or why would the artist chisel out in letters, the deeds of the departed, when most of the passers by were unable to interpret. Upon these grounds I humbly dispute the remark of Canina's: and I do so, not for the bare love of agitating subjects, which but for the curious and ingenious, would be contentedly dismissed, as unworthy and trivial; but from an anxiety to arouse the slumbering energies of the artist, and to invite a cool and rational enquiry into the antiquities, literature and minutive of his art.

Frederick East.

November, 1840.

DESCRIPTION OF THE HYPSOMETER.

An Instrument invented by John Sang, *Esq., Land Surveyor, for taking the Heights of Trees, Buildings, and other objects. Communicated by* Mr. Sang, *Land Surveyor, Kirkcaldy.*

(From the Gardeners' Magazine.)

I have taken the first leisure hour to make you the instrument for measuring the height of trees and buildings which I mentioned to you when having the pleasure of visiting you at Bayswater. It is sent by post at the same time as this letter.

The instrument was tried on some houses and trees here, and it gave their height (especially the houses) with great accuracy. It is rather difficult to manage at first, but after a few trials it becomes quite easy. The method is as follows:—

By means of a small hook (if a knot of white cloth be attached to it, so much the better), fix the end of a tape line to the bole of the tree, at exactly the height of the observer's eye from the ground. Retire from the tree, letting the tape line unwind until, by using the instrument, the top of the tree and the end of the tape line are seen quite close together. Add the height of the observer's eye to the length of the tape line, and the sum is the height of the tree. Now, the difficulty is, to catch the image of the top of the tree in the instrument, and it is this which requires a few trials, although any person who has been accustomed to use a sextant will do it at the very first. Hold the instrument at one of the milled ends, taking care that the fingers do not project over any of the holes, and that the brim of the hat is out of the way. Apply the eye to the round hole marked *a* in fig. 1, and look through in the direction of the small square hole *b*, the instrument being held so that the line joining *a b* is about level, while the large square hole *c* is turned towards the sky. You will then see some object directly through the small hole, and at the same time the image of some other object, the light from which enters the large aperture, and, after being reflected by the two mirrors inside, passes into the eye. Whatever two objects are thus seen in contact, subtend at the eye an angle of 45°, as in fig. 2; so that, if one of them be the end of the tape line on a level, or nearly so, with the observer's eye, while the other is the top of a tree, supposed to be growing straight up, the distance from the eye to the bole of the tree will be exactly equal to the distance from the end of the tape line to the top of the tree.

Fig. 1.

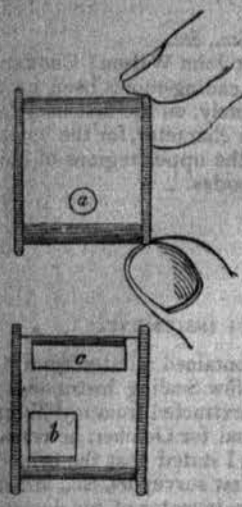


Fig. 2.

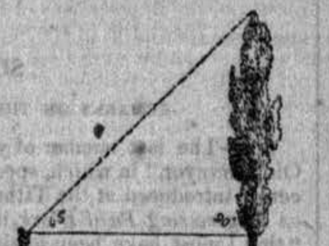


Fig. 3.

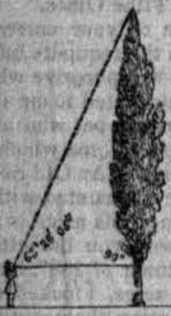
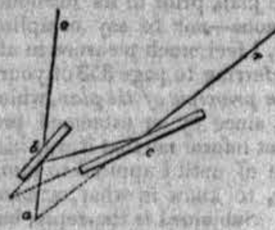


Fig. 4.



You will thus observe that the accuracy of the measurement depends on the tree being erect from the ground. On sloping ground the measurer would require to go out from the tree in such a direction that the tape line was perpendicular to the stem, but this could be judged sufficiently well by the eye to give the height, of even a very high tree, nearly correctly. The heights of those houses I tried were given within an inch, which was no doubt owing to their being perfectly upright on a level court yard.

The principle of the instrument is quite simple, being exactly the same as that of the sextant or quadrant, only that the mirrors are fixed at a certain angle instead of being movable. Thus, in fig. 3, *a* is the eye, *b* a mirror partly silvered, and *c* a larger mirror wholly silvered. A ray of light *r*, falling on the mirror *c*, is reflected from it in the direction *c b*, and again reflected from the mirror *b* in the direction *b a* to the eye; at the same time another ray of light comes from an object *o* direct to the eye at *a*, without being reflected. From the nature of reflected light, the angle *r a o* is equal to twice the inclination of the mirrors, and is constant, however much the whole instrument may be moved in the plane of the objects, as you will easily perceive by catching the reflection of the candle in the instrument, and moving it in the plane of the milled ends.

I am sure this very portable instrument will be useful for measuring single trees, or buildings, which are as far asunder as they are high, but I am afraid it will not work well in a close wood, on account of the operator not having room to retire as far from the trees as their height. If this is found to be the case, the remedy is to construct another instrument in which the mirrors are placed so as to give an angle of 63° 26′ 05″. In this case the height of the trees will be equal to twice the length of the tape, added to the height of the observer's eye. (See fig. 4.) Of course a small deviation from squareness in the trees and tape line will make a greater error than with the instrument sent, but still it will give a result near enough for all practical purposes.

I have only to add, that the mirrors are made of common window glass selected as the most even from among a great many pieces, but still they are not quite flat. I had some glass from London perfectly true and flat, but so dim and badly polished as to be unfit for use.

Kirkcaldy, Jan. 31, 1840.

Postscript in Answer to some Questions asked of Mr. Sang by the Conductor.

The instrument for measuring the height of trees is not a pocket sextant, like that of Mr. Blackadder, mentioned in vol. xiv. p. 257, although nearly allied to it. The sextant, quadrant, reflecting circle, improved Wollaston's goniometer, as well as the optical square and tree-measurer, are all varieties or improvements on Hadley's first invention. The two latter differ from the rest in the mirrors being permanently fixed at angles suitable for the purposes for which they were intended. The pocket sextant would measure the height of trees quite as well, but, being expensive, and requiring some skill to use it, it is not likely to be much employed for such purposes. There is no sort of merit in designing the instrument; and is so exceedingly simple, that I have no doubt the idea of modifying the sextant, so as to make it readily measure the height of trees, has occurred to many a one. I, however, never heard of such an instrument, and believe that the one you have is the second of its kind in existence. The other is one which was made for yourself. My father was so much pleased with it that he asked me to make one for him, which turned out neater than the first, and accordingly I sent it to you, as being the better of the two. As there is nothing like a Greek name for giving identity to it, you might call it a dendrometer, or, better still, a hypsometer (measure of height).

Of course any instrument maker could supply these articles; the price, I should think, would be about 20*s.* each. If there were any prospect of selling a dozen or two, I could easily employ a workman here to make them, and they might be sent from the seedshop to any place by post.

Kirkcaldy, Feb. 18, 1840.

BRITISH MUSEUM.

Sir—That the British Musenm is a *monument*—as the French term it, which does honour to this age and country, is what, for peace sake, I will take for granted, notwithstanding that I myself perceive nothing particularly monumental or dignified in the sulky and barrack-like aspect of the exterior of the new buildings. No one, indeed, can deny that the most frugal economy has been observed there—of course a very plain proof with what rigorous conscientiousness the cash is uniformly doled out of John Bull's public purse. Still there are illnatured grumblers who opine there are occasions when liberality bespeaks more prudence than cheese-paring economy, and is the more becoming virtue of the two; and that such an edifice as the one I am speaking of, ought to be in every respect a finished piece of architecture. Possibly, the façade—whenever that comes to be executed—may make some amends; yet it surely would have been better that the whole should be of a piece, and not like Dick Wilson's fine embroidered waistcoat, with its 'back-front' made out of one of his own picture-canvasses. It may be very true that the rest of the building is not intended to be seen, but still as it is not screened from view, it is rather hard to tax the imagination of matter-of-fact folks like myself, so far as to tell us we are to imagine we do not see what is staring us in the face, nor to give credit to our own eyesight. Upon such notable principle of economy, the backs—I mean the East end of St. Paul's, might have been left a plain brick wall; but it seems Sir Christopher's notions of economy were very different indeed from those of Sir Robert.

I find I have rather committed myself, for what I have been saying is likely to call the sincerity of my first sentence, terribly into question. No matter; it can't now be helped; and only proves that liars and critics ought to have good memories. Accordingly my willingness to 'take for granted' and so forth, must now either be set down as a palpable *hum*, or be imputed to my considerate forbearance in not discussing the architectural merits and demerits of Sir R. Smirke's edifice. I will not inquire whether the taste he has shown in the interior of the building is such as to indemnify us for its excessive homeliness without; nor whether he has been prodigal or economical in drawing upon his fancy and imagination. But I will say that however much he may have consulted convenience rather than splendour, or may have succeeded in combining both, in other parts of the plan, he has attended to neither the one nor the other in the Reading Rooms, which are about as inconvenient for the purpose as could well have been devised,—to such a degree that without taxing our fancy very much, we might fancy no instructions respecting them had been given to the architect, and that when it was afterwards discovered that the Book-makers and Novel-readers who frequent the British Museum, must be put somewhere, they were *accommodated* where they are now crammed. "Remuneration means five farthings," and in the present case accommodation means being left to shift as well as you can for yourself, and perhaps be forced to sit in dim-twilight—where if you cannot see to read, you may at least sit and muse,—which of course looks solemn and meditative, and is highly becoming in a *Muse*-um.

This is no exaggeration of mine, since it is hardly possible—except, indeed, for literary *owls*—to see to read at any of the tables on the window-side of the West room, in dull weather; those windows being at a considerable height from the floor, and there being no others at either end. Consequently one-half of it is so imperfectly lighted, that were it a church people would grumble at it as a dismal dark hole, where they could not see either to hear the sermon, or to study the newest fashions of the congregation. There may indeed be some who can see to read by their own inward light; but the generality of people will perhaps agree with me that apartments not intended merely as libraries, but as *public* reading-rooms, where instead of seating themselves just where they can see best, people must be content with the best vacant places they can find,—that such apartments should be sufficiently and uniformly lighted, so that every part should be equally commodious in that respect.

It would have been infinitely better to have had for the purpose, rooms less lofty, and lighted entirely from above, with a clerestory lantern along the centre, and skylight compartments along the sides, so as to diffuse the light as equally as possible every where. But, it will be said, it was quite out of the architect's power to do this, there being an upper floor: yet it was surely then matter for consideration whether it would not be more eligible to convert the present rooms to some other purpose, and make use of one of the upper galleries (lighted from above) as Reading-rooms. The extra trouble of having to ascend higher in order to reach them, would be amply compensated by their greater comfort and commodiousness,—for their present length might then have been considerably extended. Perhaps it will be objected—for *buts* and objections are always plentiful enough—that this would have been attended with one serious inconvenience,—namely, the distance from which books would have to be fetched were the Reading-rooms not upon the same floor as the Libraries. Yet that difficulty would be at once obviated by having a *lift* or shaft (as many as might be requisite), close by the bar where the books are delivered; and by means of which a whole cargo—if requisite, might be raised equally expeditiously and easily.

There are, however, other inconveniences in the present rooms that ought to be remedied. One is that the space is by much too confined, for either the tables ought to be nearly double their present width, or there ought to be seats only on one side, for when a person has—which is frequently the case—very large folios before him, they occasion inconvenience both to his opposite neighbour and himself: besides which sufficient space is not allowed between one sitter and another, should they both happen to have many books or very large ones by them.

Were it not that it might be deemed a piece of shameful extravagance, I would hint that it would not be omiss if a few yards of drugget or matting were purchased to lay down along the centre avenue of the Reading-rooms, in order to deaden the noise of persons perpetually passing to and fro on the stone pavement there. By way of providing the ways and means for raising the sum required for buying the said drugget, I would recommend that the open wire-work doors now enclosing the bookcases in those rooms should be taken off their hinges and sold; because so far from being of any use, they are merely a very great nuisance. Being unglazed they do not protect the books from dust, neither are they any protection whatever against plundering—if such be their intended purpose, because those cases—which contain books of reference, journals, dictionaries, &c., are accessible to any one, as he may have as many as he pleases opened in turn, if he summons the turnkey attendant, and as when once opened the cases are left unlocked, there are always several from which persons can take down books. There are, besides, always piles of books on the tables, from which a person frequenting the Museum for such a purpose, might filch away any pocketable volume, though even then he could not pawn it without first mutilating it, by tearing out the Museum stamp-mark. Therefore in the way of precaution against filching books, the doors to the cases in the Reading-rooms are quite nugatory—a mere idle show of carefulness and security. In themselves, however, they are a nuisance, not only as imposing needless trouble and bustling about, to both attendants and visitors; but because they are actually in the way when opened, while persons are referring to the books, there being then no room for other people to pass between them and the tables. If, therefore, there must be doors to those bookcases, the tables ought to be shortened two feet, so as to allow greater space between the ends of the tables and the walls. I will not now speak of the Catalogues except to say that I believe they are blessed undevoutly backwards, every day and all day long. Neither will I now touch upon the literary wealth of the Museum in those departments which are most likely to interest your own readers, it being utterly impossible to do justice to either topic at the fag end of my present letter; I must, therefore, reserve them for another. That some improvements have taken place of late years I do not deny, but still the Museum requires a good deal of poking up, before it will be placed upon the footing which it ought to be.

I remain, &c., &c., &c.,
JOHN [but not John Wilson] CROKER.

P.S. I forgot to remark that had the Reading-rooms been on the floor above that where they now are, namely, on the first floor from the sky, they would have been much more in character, for the votaries of literature have always greatly affected the upper regions of buildings—vulgarly termed garrets—for their abodes.

SURVEYING.

REMARKS ON THE NEW SCALING INSTUMENT.

SIR—The last number of your Journal contained a letter from "An Old Surveyor," in which, speaking of the New Scaling Instrument recently introduced at the Tithe Office, and extracted from my *Treatise on Engineering Field Work*, into your Journal for October, he remarks "that I must have been misinformed when I stated that the principle of the plan had long been known to some few surveyors, &c., and also believing that I did not wish to deprive the inventor of his due share of credit, to state who were the parties acquainted with the principle of the plan, prior to its introduction at the Tithe Office." From the courteous—not to say complimentary tone of your correspondent's letter, I feel much pleasure in affording him the requisite information. By referring to page 353 of your Journal, he will perceive what I mean by the *principle of the plan*, which was communicated to me about three years since by an esteemed professional friend, but who at the time did not inform me that it was his own conception; and which I was not aware of until I applied to him, since reading "An Old Surveyor's" letter, to know in what manner he became acquainted with the process. Subjoined is the reply, but at his request his name is withheld; but for your correspondent's satisfaction, I send you the letter to take the requisite particulars from. In the autumn of 1837, he observes, "being engaged upon a survey of 12,000 acres, I looked with some degree of concern at the drudgery of computing the quantities. Mr. B. had previously explained to me his mode of ruling parallel lines across the several enclosures, but this method I thought would be troublesome, and be attended with the risk of injuring the maps. The idea then occurred to me of using a thin piece of horn ruled with lines one chain apart. In the interval that elapsed between my sending for, and receiving the horn, I made of tracing paper the machine I described to you, and find it to answer my purpose, used it to the end of my survey in the spring of 1838, since which time it has not seen the light, but is no doubt amongst my old papers."

I think the above particulars must be satisfactory to your correspondent, at least I hope so; and now perhaps I may be excused asking him, who the inventor of the modified instrument at present in use at the Tithe Office, is? for certainly there is great credit due to him, and which I indeed stated in my work, when I called it an "ingenious application of the above system." If an Old Surveyor will favour me with this particular, I shall have much pleasure in mentioning it in the second part of my work shortly to be published.

I remain, Sir, your's very obediently,
PETER BRUEF.

Charlotte Street, Bloomsbury, Nov. 16, 1840.

SIR—An "Old Surveyor" in your last number doubts the remark made by Mr. Bruff, that the *principle* of the New Scaling Instrument had long been in use by some few surveyors.—In reply I beg to observe that I have known many surveyors of the old school who worked on this principle, by means of a long scale and pricker, taking the amount of the chain widths and transferring them into acres, roods and perches by the decimal table; the new instrument has certainly much improved the system, and having the parallel lines on glass-paper is a further improvement. The old system was a very defective one, and repudiated by all really practical men. As to the new instrument, after using it in my office for many months, and in various large surveys—I find it unsatisfactory, it is after all (notwithstanding its high recommendation) best adapted for the schoolboy and the tyro.

I am not surprised at its general adoption, for the former approved system of equalizing into trapeziums and triangles is very laborious work, if pursued for a length of time successively, but after giving both a fair trial, I must say I find the old system the most expeditious and certainly the most satisfactory. One feels no satisfaction with the instrument without repeating the operation, in repeating, the results will not always be the same, a third or even a fourth operation will frequently be required, each time requiring the whole to be done over again; whereas by allowing two young hands to figure for each scaler, they check one another, and repeating the operation from opposite points, prevents any serious errors by using proper precautions.

Perhaps I have a little feeling with yourselves against "ready reckoners," but I have experience on my side, and I have laid the *instrument* on the shelf.

It is a pity to see practical men recommending such games of marbles as your Dublin correspondent, if he would work with *eleven* arrows and make *frequent* use of his pen, he would bequeath his marbles to his children. Every *surveyor* should follow his own chain in long lines, and stopping to book his changes, stations, crossings, &c., will find him plenty to do, without carrying a marble bag.

The number of mushroom surveyors whom the pressure of business have hatched into life, has detracted much from the respectability of the profession, the public however are beginning to find out, that old and tried hands are most to be depended on; an engineer too may be a good surveyor in theory, but he will never come up in the field to an old fashioned surveyor. I do not know any thing that would give me greater pleasure than to give a certain eminent gentleman in that line, (well known to our profession, for his upright, impartial, and gentlemanly demeanour), one week's *practical surveying*, he would find there was but little "Sham Abraham" in it.

I shall conclude these few remarks by again assuming a name under which I have before entered your columns,

As your very obedient servant,

"SURVEYOR."

Ashford, *Nov.* 14, 1840.

ON REMOVAL OF EARTH-WORK FOR EMBANKMENTS.

SIR—In your Number 38, for November 1840, at page 392, you state that "up to April 1837, not even 200,000 cube yards had been teamed to embankment on one face, in one year."

Between Nov. 2, 1839 and Oct. 17, 1840, there were tipped, according to my official returns, on the Birmingham and Gloucester Railway, on one face of embankment, across the valley of the river Rea, near Birmingham, 293,246 cube yards; the mean lead being 1¾ miles, and the extreme height of embankment 62 feet from the meadows. I believe that a ratio of progress fully equal to the above, was maintained not far from Gloucester on the same railway, for a few months in the Autumn of 1839; but as the work was then in the hands of the Cheltenham and Great Western Company, I cannot give you farther particulars. I am under the belief that other engineers could supply you with information as to larger quantities than the above being tipped in the same space of time.

I am, your's faithfully,

W. S. MOORSOM, *Engineer*.

[Communications similar to the above are of great importance to the profession; we hope other engineers will follow Mr. Moorsom's example, and favour us with the result of their observations.—ED.]

THE NAPOLEON MONUMENT.

MR. EDITOR—Having in the September number of your highly interesting periodical, perused an article under this head, and feeling a deep interest in the subject, I take the liberty of sending you my own opinion; though, whether it is likely to effect any good, or is worthy of insertion in your Journal, your able judgment will best decide.—During a recent visit to Paris, I was particularly struck by the exhibition (mentioned in the above number) of a full size model of the intended testimonial to the Emperor in the Dôme des Invalides, as not being altogether consistent with that good taste so frequently displayed in the French capital. To every one who has seen the effect of the Baldachino in St. Peter's, at Rome, which is universally acknowledged a complete eye-sore, this striking similarity of arrangement must evidently tend to give the same result. The magnificent Dôme, being itself such a tastefully decorated room, can, according to my ideas, by no means suffer any erection, like this complicated, by an equestrian statue crowned monument, to dispute its grand simplicity. A colossal statue of the hero, say from 18 to 24 feet high, *cast in white metal and frosted*, erected on a circular pedestal of Egyptian porphyry, in the centre of the large Mosaic star, would methinks produce a different effect. The sublime grandeur of the Egyptian colossi, all rude and mutilated as they are, speak for themselves, and in behalf of my opinion. They likewise convince me that supernatural size would here especially answer the purpose. I suggested my idea on the spot to a friend present, and have since found no reason to make any alteration.

Your's most respectfully,

C. TOTTIE.

14, *University Street*, *Nov.* 9, 1840.

COMPETITION DESIGNS.

K. P. S. IN REPLY TO MR. SPARKE.

SIR—It gives me much pleasure to see in your number for the present month, that you have other correspondents who interest themselves in the subject of competition, and it is with especial satisfaction that I have read the answer of Mr. Sparke, to my letter on the subject of the Bury affair, since it leaves every essential fact in my statement unshaken, except one. Nobody can be imposed upon for one moment by the mist of words in which the Hon. Sec. flatters himself he has enveloped the truth.

It seems I have been misinformed as to the amount of the contract, which is £3,353 instead of £3,550. What then? Does the amount affect the moral principle?

There certainly are cases which differ from competitions, inasmuch as the law is apt to take cognizance of them, in which the proper name by which the transaction is called, varies according to the pecuniary amount involved in it, but as we cannot suppose the Hon. Sec. to the subscribers means to insinuate any analogy, we must conclude that he argues like the damsel who excused her peccadillo because it was "*a very little one.*"

As to the conundrum about the duties, it is too shallow to be respectable. The contract is £3,353,—there is £230 to be laid out in foundations, which it was evident must be laid out to all but those determined not to see, and then there is the painting and plastering. £350, supposing it to be so much, will not cover an excess of upwards of £600.

Though quite unnecessary for the argument, I will beg your readers to peruse the clause referred to by Mr. Sparke relative to the duties. Will any one undertake to say whether it is intended to mean that the duties are or are not to be considered in the estimate. It is most ingenious, and well calculated to maintain a quibble upon. Where the meaning is obscure, we must enlighten it by the context. "*If the subscribers shall be unable to find a respectable builder willing to execute the design of any architect for the sum of* £3,000, *such architect shall have no claim of any kind upon the subscribers,*" &c. This at least is plain English, and I shall take the liberty to believe it can have but one meaning, even though it should be explained away as satisfactorily as Lord Peter proved his shoulder-knot to mean neither more nor less than a broomstick,* or as Mr. Sparke has explained away all the rest of my statement.

But one word more—I will not dispute whether the contrivers of this business were *called* a committee, but it is notorious to all Bury that it was managed by a *clique* who, according to Mr. Sparke's showing, turn out to have been as irresponsible as they were officious. I could name an occasion on which one of the leading members expressed himself in no measured terms, upon some symptoms of dissent from his authority, shown by other parties concerned.

Enough of this, and more than enough for any good it is likely to produce. I have said before, and say again, that reform must come from the profession, and to them I would recommend a very simple plan, by which it may be effected, viz., that every one should reform himself. In the mean time, Sir, accept another contribution to the *facts*, which I hope to see accumulated, until architects shall be ashamed to rake in the filthy puddle of competition at the command of every body and any body. For reasons which will instantly be appreciated, I omit all names.

It is now nearly two years since the following advertisement appeared in the public papers:—

"To Architects.—Any architect desirous of competing for the proposed enlargement of W—— church, must send in his plans, specifications, and estimates, free of all charge or expence, to the Secretary, the Rev. Mr. T——, Vicarage W——, on or before the 19th January, 1839. For farther information apply to the Secretary."

Application having been made for farther particulars, the following were furnished in reply:—

---

* See the Tale of a Tub.

"That the committee would require a plan of the different floors of the church, showing the present arrangements and proposed alterations, an elevation of each front affected by the proposed alterations, a longitudinal and transverse section showing the timbers of the roof, &c., together with a detailed specification of the works, and estimate of rendering the church, both inside and out, fit in every respect for public worship. An additional estimate of what would be the expence of repewing the present church on a better plan, in conformity with the proposed new addition. An estimate of the expence for an additional gallery.

"That the limited amount of the funds would not allow of any premiums being given for the plans.

"That the committee considered it indispensable for the competitors to inspect the church.

"That a commission of five per cent. on the sum expended would be allowed to the architect for his plans, &c., including the superintendance of the works."

And now, gentlemen of the profession, what do you suppose was to be the amount of this commission for the *chance* of which all this was to be done, and a journey to be made to W—— at the candidate's expence?

"That the Secretary informs the several architects that the sum to be expended will *not exceed four hundred and fifty pounds!!!*" I write it at length that no one may suppose a figure has been dropped.

The following letter, part of the correspondence, is too curious not to be given entire. The *naïve* impudence of the latter part will not easily be surpassed:—

"*W——, January* 5, 1839.

"SIR—In answer to your's of this morning, I beg to state that the committee desire me to say that they consider a personal inspection of the church necessary. Should you consider this worth your while, I shall be happy to give you any information in my power on the subject. I should state that the length of the church is 60 feet by 16 feet 10 inches, so that the work will be on a small scale. The amount to be expended will not exceed £450. *The Rector of the parish is an Architect, but has not informed me whether he intends to compete for the work.*

"I am, Sir, your obedient servant,
"H—— S——."

Begging every architect who values the respectability of his profession to lend his aid in exposing these scandalous practices.

I remain, Sir, your obedient servant,
K. P. S.

Nov. 13, 1840.

ATMOSPHERIC RAILWAY.

IN our last monthly number we published a letter received from Mr. Pinkus, commenting on an article in our July number on the atmospheric railway, in which he complains that great injustice had been done him, by giving credit to Mr. Medhurst "for having originated the idea of employing the power of the atmosphere against a vacuum created in an extended pipe laid between the rails, and communicating the power thus obtained to propel carriages moving on a road," and to Messrs. Clegg & Samuda "for having rendered this idea practicable and useful, by their simple and ingenious invention of constructing and closing a continuous valve, by hermetically sealing it up with a composition each time the train passes."

In treating on scientific inventions of interest, this Journal pursues the undeviating course of giving the fullest and clearest information, preserving the strictest impartiality as to the inventors; conferring praise where it is justly due, and pointing out error where we consider it to exist. Mr. Pinkus, after denying *in toto* all we have said of Medhurst and of himself, describes himself as "an humble labourer in the field of science," who would "never be guilty of that meanness of mind that would detract from another the merit justly due to him for any mental production." This principle we admire, and cannot but regret that he should have lost sight of it in the very next paragraph of his letter, where he attempts to deprive Medhurst of the praise we awarded him, by describing Papin as the author "of employing the power of the atmosphere against a vacuum." We are aware that this is due to Papin, but if Mr. Pinkus had not stopped short, but quoted our whole sentence, Medhurst must have come in for the praise we justly awarded him, viz. "of using the power of the atmosphere against a vacuum created in a pipe laid between the rails, and communicating the power thus obtained to propel carriages on roads,"—a very different thing from simply "using the power of the atmosphere against a vacuum," which we were fully aware originated with Papin, had been followed by Lewis in 1817, and Vallence in 1824. Returning, then, to the original idea of employing atmospheric pressure against a vacuum inside a pipe, and communicating that power to carriages moving on a road outside it"; we see nothing to alter our assertion that it is the invention of Medhurst, who published a detailed account of the means he employed, in 1837.*

Indeed, however reluctant Mr. Pinkus may be to admit this fact, the following extracts from Medhurst's pamphlet, places the matter beyond all doubt.

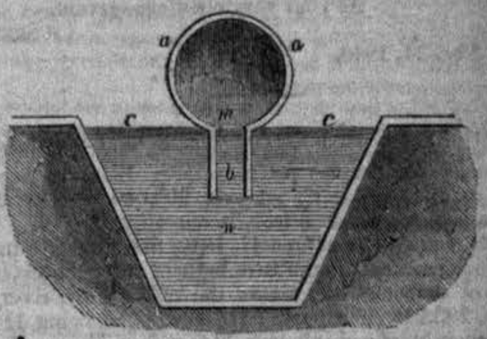
In page 15, this passage occurs—

> When the carriage is to go through the canal, from the engine, the air must be forced into the canal behind it; but, when it is to go the contrary way, the same engine is to draw the air out of the canal, and rarify the air before the carriage, that the atmospheric air may press into the canal behind the carriage, and drive it the contrary way.

In the following page 16, he says—

> It is practicable, upon the same principle, to form a tube so as to leave a continual communication between the inside and the outside of it, without suffering any part of the impelling air to escape; and, by this means, to impel a carriage along upon an iron road, in the open air, with equal velocity, and, in a great degree, possessing the same advantages as in passing withinside of the tube, with the additional satisfaction to passengers of being unconfined, and in view of the country.
>
> If a round iron tube, 24 inches in diameter, be made, with an opening of 2 inches wide in the circumference, and a flanch 6 or 8 inches deep on each side of the opening, it will leave a channel between the flanches, and an opening into the tube. If the flanches of this tube are immersed in water up to the circumference, as represented in fig. 1, where *a, a,* is a section of the tube; *b,* the channel; and *c, c,* the surface of the water.

Fig. 1.



> If such a tube is laid all along upon the ground, with the iron channel immersed in a channel of water, up to *m*, and a piston or box made to fit it loosely, and pass through it upon wheels or rollers, this box, driven through the tube by the air forced into it, may give motion to a carriage without, by a communication through the channel and the water.

Again in page 20, he describes

> A plan to combine the two modes together, that, the goods may be conveyed within the canal, and a communication made from the inside to the outside of it, so that a carriage may be impelled in the open air, to carry passengers, would be an improvement desirable and practicable. It must be effected without the aid of water, that it may rise and fall as the land lies; and it must give a continual impulse to the outside carriage, without suffering the impelling air to escape.

And aware that his only difficulty was in constructing a means of confining the power in the tube by using a valve in lieu of the water joint, he remarks, that

> For this purpose, there must be some machinery which will diminish the simplicity, make it more expensive, and more liable to be disordered, unless executed in the most substantial and perfect manner; but, by skill, by experience, and sound workmanship, it may be accomplished in various ways, one of which I will describe, which, I presume, will evince the practicability of it.
>
> In order to make this in the best manner, the top of the canal should be made of wrought iron (or copper) plates, rivetted together, and rivetted all along, on one side, to a cast iron rail securely laid upon the top of one of the side walls; and made to shut down close, and air-tight, upon a cast iron rail laid firmly down upon the other side wall.
>
> In order to make the plate shut down air-tight upon the cast iron rail, without being rivetted to it, there should be a groove all along, upon the top and inner edge of the cast iron rail, and a thin edge of iron rivetted to the plates all along, to fall into the groove; then, if the groove is partially filled with some soft and yielding substance, as cork, wood, leather, hemp, &c., the thin iron edge will bed itself into it, and shut so close that the air will not escape, with so light a pressure as one pound per square inch.
>
> The plate that is to form the top of the canal, being thus prepared, may be

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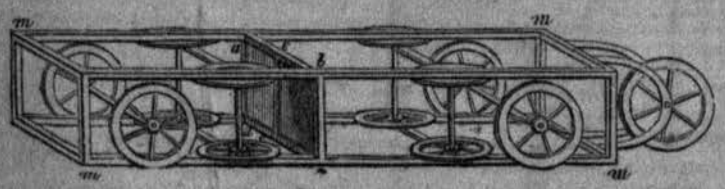
* This work was entitled "A New System of Inland Conveyance."

> lifted up out of the groove two or three inches high, in any particular place of the side that is not rivetted; and, when let down again, the edge will fall into the groove, by the spring and weight of the plate, and stop close as before.
>
> Therefore, if there is a large and light iron wheel fixed in the front of the interior carriage, and close to the side wall on which the plate shuts into the groove; and if this wheel is planted to stand two inches higher than the under side of the covering plate, this wheel, as it passes along, will constantly lift up the plates, and make an opening of two inches wide, or more, and 8 or 10 feet long; and, when the wheel has passed, the plate will fall down into the groove, and close the joint, as before.
>
> Through this opening, a bar of iron may pass, that is fixed to the interior carriage, may project over the side wall, and the outer end may be attached to the exterior carriage by a chain or strap, and pull it along upon its own wheels and wheel track, which should lie along by the side of the wall of the canal.
>
> The iron bar will not touch any thing as it passes through the opening, for the iron covering may be lifted up two or three inches high; but the bar need not be more than one inch in thickness.

In page 24, he says—

> The same principle, and the same form, may be advantageously applied to convey goods and passengers in the open air, upon a common road, at the same rate of a mile in a minute, or sixty miles per hour; and without any obstruction, except, at times, contrary winds, which may retard its progress, and heavy snow, which may obstruct it.
>
> If a square iron tube be formed, 2 feet on each side, 4 feet in area, with three sides, and one-half of the top, of cast iron, the other half of the top made of plate iron or copper, to lift up and shut down in a groove in the cast iron semi-top plate, as before described; and if a strong and light box or frame be made to run upon wheels, within the tube, and an iron arm made to pass out, through the opening made by lifting up the plate, as before described, this arm may give motion to a carriage in the open air, and upon the common road, without any rail-way, if the pressure within the tube is made strong enough for the purpose.
>
> The opening of the iron plate should be made in the middle of the top, so that the iron arm may pass out, and stand upright a few inches above the top, to which the strap should be attached, to communicate motion to the carriage.
>
> The frame or box, within the tube, should be 10 or 12 feet long, and must be guided by wheels, on all sides, as large as can be admitted, and as truly formed and planted as possible; the number will be 14 or 16.
>
> A piston, or vane, must be formed near the middle of the frame, to intercept the air, and must be leathered all round, so as lightly or barely to touch the sides of the tube.
>
> The inside, or middle of this vane, should be open, and the opening filled up and closed by a valve, suspended by an axis across the middle of the opening, so that this valve, by turning on its axis, may open the vane, and suffer the air to pass through, and prevent its impulse upon the vane and carriage, or, by closing the valve, intercept the air, and give it motion.
>
> By this means, the conductor of the carriage may restrain and limit the velocity, and stop the carriage, at any time and at any place, by a communication from the valve, through the opening, to the conductor on the outside; and this will be done without the least violence, shock, or chance of disordering any thing, either within or without.
>
> Fig. 2 represents the vane within its frame *m*, *m*, *m*, *m*; the outside edge of the vane, *a*, *b*, *c*, *d*, is leathered all round, and the middle part, *o*, *p*, *q*, *r*, is open, and is to be closed by the double valve, that is to turn upon its vertical axis *e*, *e*. The valve will shut, half on one side of the vane *a*, *b*, *c*, *d*, and half on the other; when it is shut, the air will be intercepted, and the impulse of the air will be given to the carriage; but, when the valve is turned a quarter of a circle, it presents its edge to the air, and leaves the interior of the vane open for the air to pass by unobstructed, when the carriage will gradually be stopped, by the friction of the road and the resistance of the outward air. It may be put in motion again, as soon and as gradually, by closing the valve.
>
> *m*, *m*, *m*, *m*, is the box, or open frame, that is to pass through the tube, on the wheels *n*, *n*, *n*, *n*, *n*, to support the vane, and the iron arm, and to be impelled by the air in the tube.

Fig. 2.



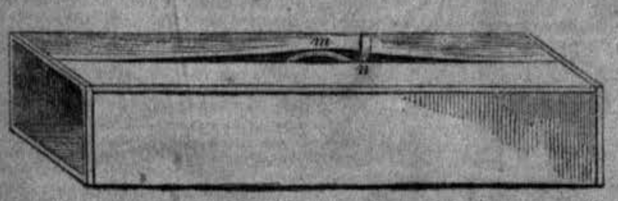
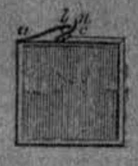


Fig. 4.

Fig. 3.



> Fig. 3 is a section of the iron tube, with the wrought iron semi-top, *a*, *b*, rivetted to the flanch, and represented as lifted up by the projection of the wheel under it; and of the crooked iron arm *n*, as it is to come out through the opening, and stand up for the carriage to be attached to it.
>
> The semi-top of cast-iron, *o*, *p*, is to be screwed upon the tube by the flanch *p*, and, at the edge *o*, is a small projection, which the edge of the wrought iron is to cover, to prevent the rain or dust from entering into the tube.
>
> Fig. 4 represents a part of the tube, with the semi-top as lifted up at *m*, and the section of the crooked iron arm, *n*, as it is to pass out of the opening, besides the wheel that lifts it.
>
> The iron tube should lie in the ground, with the top of it a few inches above the surface; and the carriage should run over it, with the wheels on each side; then the iron arm *n*, would draw the carriage in the fairest position.
>
> The opening being, in this plan, made in the middle of the top of the tube, instead of the side, the lifting wheel will act either way, without being removed; but the iron arm that passes through the opening (to draw the carriage), as well as the arm that is to pass through (to open and shut the valve), must be changed to the other side, when the motion is changed to a contrary direction.
>
> If the carriage is attached to the regulating arm that is to pass through the opening, and that arm is supported by the main bar, the effect will be, that, if by any accident the chain should let go its hold of the arm, the inside valve would instantly fly open; and the vane, being no longer impelled, would soon stop of itself, and the chain might be replaced.

In summing up this invention he remarks,

> Although the perfection of this work is not to be obtained but by time, skill, experience, and the wealth of a nation, yet, upon a smaller scale, and less rapidity, the expense will be moderate, and within reach; and the value of it, compared with the present mode of conveyance, would be abundantly advantageous and desirable.

Here then is a clear and full explanation of a mechanical arrangement for employing the power of the atmosphere against a vacuum inside a tube, and communicating the power so obtained to carriages moving on a road on the outside.

No impartial person, and not even Mr. Pinkus can read these passages without being convinced that this most ingenious, though unfortunate inventor Medhurst, had brought the atmospheric system to the point where it was taken up by Messrs. Clegg and Samuda, and that his great practical failure was, that he could not, and did not make the valve air-tight, upon doing which the entire success of the system depended.

And now that we have shown what Medhurst did, and what he failed in, viz., "in making a continuous communication from the inside of the pipe to the carriage tight enough to allow a useful degree of rarifaction to be produced;" we will examine what progress the invention has made since then.

On the 3rd January, 1839, Clegg and Samuda obtained a patent "for a new improvement in valves and the combination of them with machinery." This valve, says the inventor, "works in a hinge of leather, (or other flexible material which is practically air-tight), similar to the valves commonly used in air-pumps. The extremity or edge of these valves is caused to fall into a trough containing a composition of beeswax and tallow, or beeswax and oil, or any substance or composition of substances which is solid at the temperature of the atmosphere, and becomes fluid when heated a few degress above it; after the valve is closed, and its extremity is laying in the trough, the tallow is heated sufficiently to seal up or cement together, the fracture round the edge or edges of the valve which the previous opening of it had caused, and the heat being removed the tallow again becomes hard and forms an air-tight joint or cement between the extremity of the valve and the trough. When it is requisite to open the valve, it is done by lifting it out of the tallow with or without the application of heat, and the before named process of sealing it or rendering it air-tight is repeated every time it is closed.

The inventor then goes on to describe how, by means of this valve in combination with a line of partially exhausted tubes, it may be rendered useful to move weights on railways. The combination employed being described precisely similar to that invented and published by Medhurst. The only claim set up in the patent being "the method of constructing and using valves as above described." The success of this valve has been demonstrated by six months experience on the Thames Junction Railway, and as the whole combination there employed, *except the valve and mode of sealing it*, is precisely that invent-

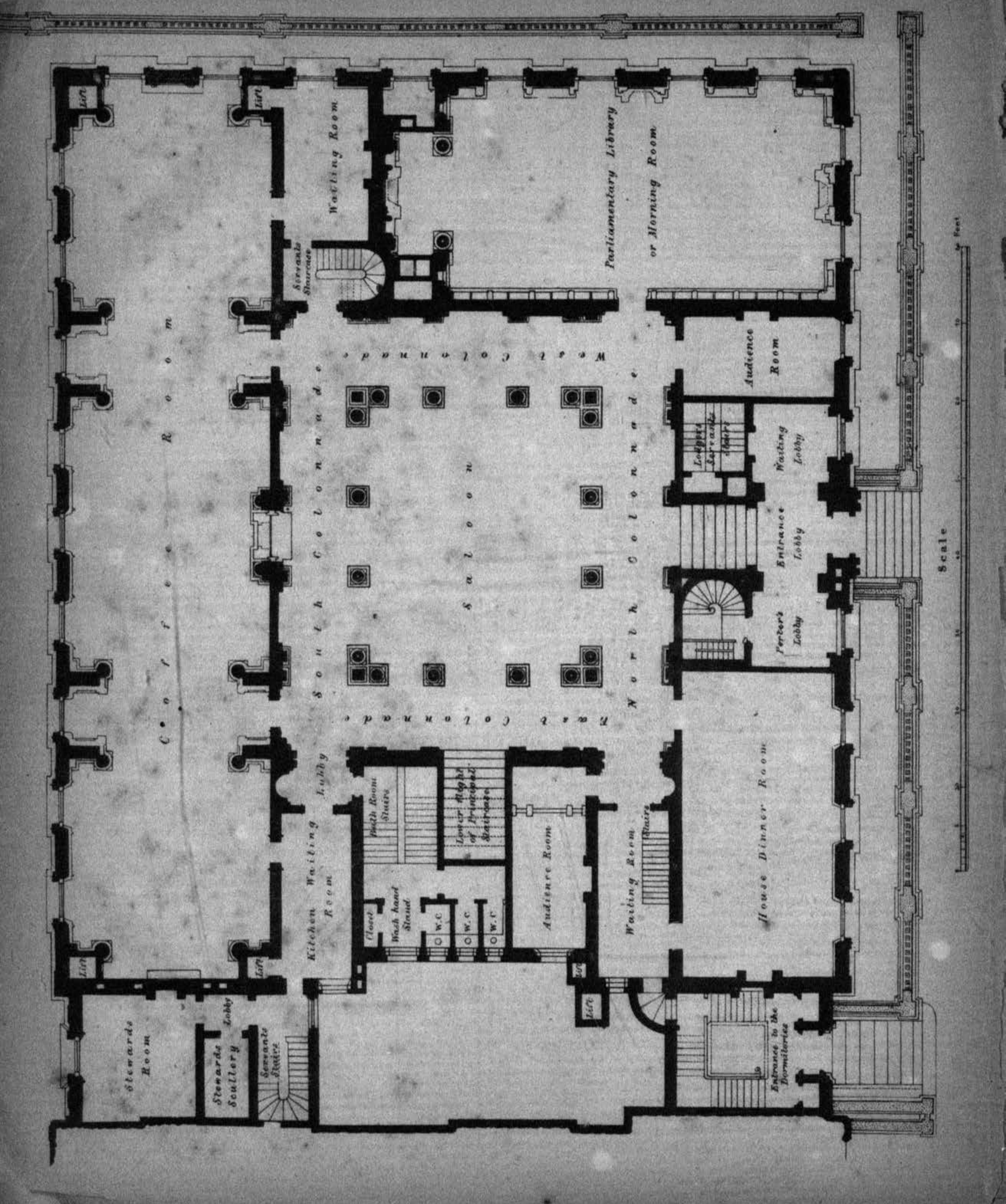
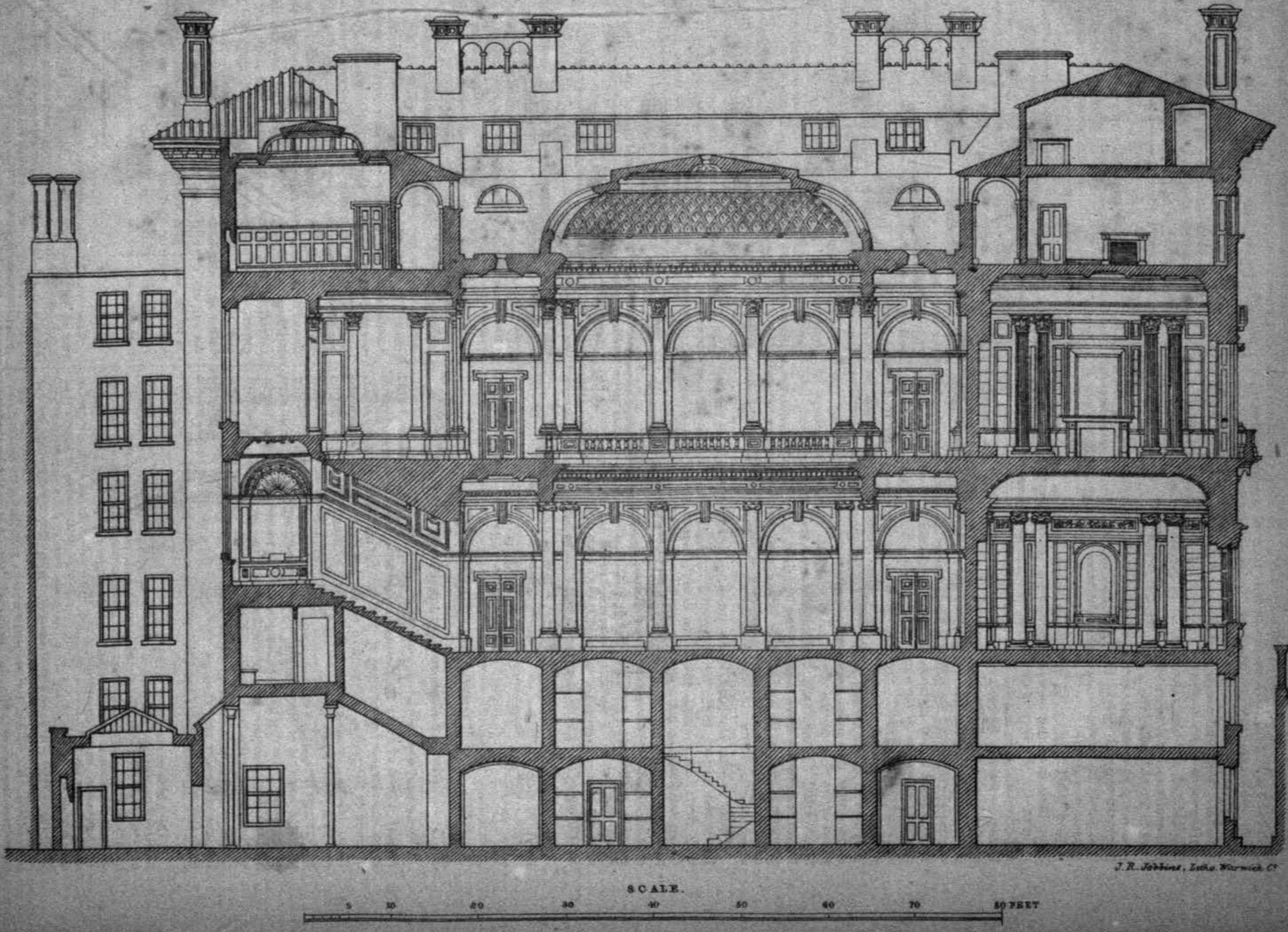

Lift
Lift
Waiting Room
Parliamentary Library
or Morning Room
Servants Staircase
Coffee Room
West Colonnade
South Colonnade
Saloon
North Colonnade
East Colonnade
Audience Room
Lodgers Servants Stairs
Waiting Lobby
Entrance Lobby
Porter's Lobby
House Dinner Room
Lift
Kitchen Waiting Lobby
Kitchen Waiting Room
Bath Room Stairs
Lower flight of Principal Staircase
Closet
Wash hand Stand
W.C
W.C
W.C
Audience Room
Waiting Room Stairs
Lift
Lift
Stewards Room
Stewards Scullery
Lobby
Servants Stairs
Entrance to the Dormitories
Scale
Feet

PLATE XIX

Reform Club House

Section from East to West through the centre of
Saloon and First Floor Stairs



J. R. Jobbins, Litho. Warwick Ct.

ed and published by Medhurst,—it follows that to Clegg and Samuda is due the credit of perfecting what he began.

Now let us see what Mr. Pinkus has done. His first patent we find is dated 1st March, 1834, in this he sets forward a combination precisely similar to that published by Medhurst seven years previously, only proposing to use a rope for his continuous valve, which he terms a valvular cord, and which he describes thus: "A flexible cord E lies in the groove at the top of the cylinder, for the purpose of closing the longitudinal aperture; this cord is to be of the same length as the pneumatic railway, and to fit tightly into the groove or channel. The cord is passed under the wheel *c*, and over the wheel P; and its purpose being to close the opening in the cylinder, it is required to yield freely when acted upon by the apparatus, and it should be made heavy, and it may be pressed down into the groove by the wheel W, which passes over it."

Now if Mr. Pinkus can prove any better result to arise from this rope than from the valves suggested by Medhurst, he has a perfect right to it. We fear, however, that the success he says, attended his experiments made in 1835 on a model, could not have been very flattering, as we find he took out another patent in 1836, "For improvements in inland transit," in which he says, "the method of carrying it into practice consists in a method or in methods of constructing the pneumatic valve and the valvular cord, and in the manner of using the same, one of which methods hereinafter described, I design *to substitute for and in lieu of the valve and cord described in the specification of my said former patent.*" He then goes on to describe a valve formed of iron plates secured to felt to lay against pieces of wood, which he proposes to fix to the inner sides of the trough, as presenting a smoother surface than cast iron. He next describes a spring copper valve fastened at its foot to the pipe, and meeting at the top in the shape of an inverted V; and lastly, a combination of the two, viz., using half the spring copper valve against the upraised side of the trough, and pressing it against its surface with the valve with iron plates, as before described, which in this case acts as a wedge pressing against the side.

These valves, however, could not have pleased him much better, for on 3rd August, 1839, he obtained a third patent, in which he not only describes a valve similar in every respect to that of Messrs. Clegg and Samuda, but also proposes to seal it with a composition to be rendered fluid and solid, as described by them; with the sole exception of using a galvanic wire instead of a heater to melt the cement. As this patent was enrolled eight months *after* the publication of Clegg and Samuda's specification, we cannot but think that their invention was instrumental in leading Mr. Pinkus' ideas to this valve, as nothing of the sort is discoverable in either of his previous patents.

[Erratum.—For 1837 read 1827, p. 407, 2nd col., 4 lines from the top.]

REFORM CLUB-HOUSE.

(*With* 2 *Engravings, Plates* XVIII. & XIX.)

Fully to describe and explain the interior of the structure would require a plan of every floor—amounting altogether to six, besides as many sections, to say nothing of particular sections on a larger scale, of some of the rooms, perspective views, and drawings of ceilings and other details: in short it would demand a volume similar to that on the Travellers' Club House.* Of course we cannot devote so many engravings to a single edifice, though it be one so deserving of attentive study as this of Mr. Barry's; nevertheless a sufficiently clear idea of the general arrangement, of the sizes of the rooms, and of the height of the different stories, may be obtained from the ground floor plan and section through the building from East to West. Being confined to a single section, we have judged this last to be the best for our purpose, because although one through the centre from north to south, would have shown the ascent from the vestibule to the hall, and the coffee-room and drawing-room above it, it would have shown merely the end elevations of those apartments, not their longitudinal ones—which are their more important ones; whereas the line of section chosen makes no difference as regards the hall, while it explains the character of the staircase, and the room over it, and also shows the kitchen court, at the east end of the building. When, however, we say none, we mean that it makes no other difference in respect to the hall itself than what is evident from the ground plan, namely, that in this direction the three intercolumns are of equal width, whereas the east and west sides being somewhat shorter, the lateral intercolumns are narrower than the centre one, on which account those elevations are better than the others, where the columns are wider apart than is altogether consistent with the richness of character here observable in other respects. This excess of width in the intercolumns is not so apparent in our drawing, because that being both a geometrical and outline one, it is the plan which chiefly explains that the arches between the columns belong to a different plane, viz., that of the wall within the colonnades. Hence it is likely enough that from the first glance at the section it will be supposed that, instead of being insulated the columns are attached to the piers of the arches, in which case the intervals between them would not be too great. It becomes a question, therefore, whether it would not have been better, to enclose the lower part at least of this saloon by open arcades so decorated, whereby a character of solidity would have been there produced, that would have served to relieve and set off the upper colonnades. Still wherefore that idea—supposing it to have presented itself—was not adopted is sufficiently apparent from the plan being neither a perfect square, so as to allow three arches of equal width, on each of its sides; nor so much greater than a square as to afford five spaces—whether arches or intercolumns, on each of the longer sides. Perhaps as the deficiency in the breadth from north to south, could not be supplied without intrenching too much upon other parts, it might have been adviseable to have got rid of the excess in the other direction, curtailing—not the entire hall, but merely the cetral space within the columns, reducing that to a perfect square. By this means, indeed, the breadth of the east and west colonnades would have been somewhat increased, yet that objection might have been got over by apparently contracting the width, putting columns against the wall, corresponding with those in front, and so as to render the distance between them equal to the breadth within the north and south colonnades. This adjustment of the plan, reducing the centre to a square of 28 feet, instead of 34 × 28,—might have rendered some other modifications requisite, and among the rest, some abatement of the present height.

If we have thus far taken the liberty of objecting to what we regard as a rather offensive irregularity as regards the colonnades, we commend the mode of grouping of two columns and square pillar, here employed at the angles, which produces a very desirable fulness of effect, as well as appearance of solidity at those points, and at the same time avoids the confusion—and perhaps heaviness withal—that might have resulted from three columns similarly placed. Another pleasing and, we believe, original circumstance is, that in the upper and lower colonnade on the south side, a view is admitted into the coffee-room and drawing-room over it through the centre arcade, which is to be filled in with plate glass to within a few feet of the floor, that is, to the level of the chimney-piece. By this means, the saloon itself will always present a striking architectural scene as so viewed from either of the two principal apartments, especially of an evening when brilliantly lit up. The mode also of lighting the saloon entirely through the cove, appears to us both a novel and happy one, although we can at present merely guess at its effect, it being quite blocked up with scaffolding when we last went over the interior of the building, when very little progress had been made in the decorations, or rather, they were hardly commenced at all, nor was it begun to be paved. The staircase was also then a mere shell, with brick walls, and without any steps. Consequently, until we can see the interior again, in a much more advanced, if not perfectly finished state, we can add very little to the information the plan and section supply as to the parts just mentioned. For which reason, we must be allowed to reserve further description for another opportunity, and request our readers to consider the present account merely a provisional one.

Ryde, Nov. 7.—The committee appointed to decide on the plans for our new church, have selected the designs of Mr. T. Hellyer, architect. It is a handsome structure, and the interior is composed after the model of the Temple church in London. The subscriptions for the building are progressing steadily, and the contributions for enclosing the new burial-ground already amount to more than 150*l*. Too much praise cannot be given to our vicar, the Rev. W. S. Phillips, for the energy and exertions he has put forth to accomplish these two important objects.—*Hampshire Advertiser.*

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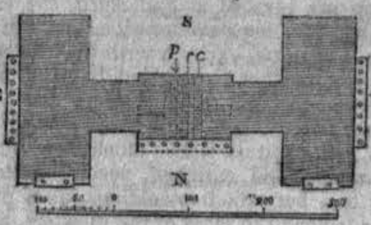
* The whole of the plates in that work have lately been pirated in the most barefaced manner by the editor of the Revue Generale d'Architecture, without the slightest acknowledgement, or mention of the source whence they have been taken, notwithstanding that a copy of the publication was actually given to the French editor in order that he might give a notice of the book! Yet instead of doing any thing of the kind, he does not even inform his readers that there is such a volume in existence, but makes it appear that both his article and the plates are entirely his own, and the information collected by himself while he was in London. It is true the drawings are not exactly facsimiles, for they are considerably reduced in scale from the originals, and in other respects far less satisfactory: still that circumstance does not cancel the act of piracy, or the injury done by it to the English publisher.

ARCHITECTURE OF LIVERPOOL.

Sir—When I first saw the remarks of your correspondent "Eder" in a Liverpool paper, I felt strongly disposed to make a few observations in reply to some of them, which seemed to me strangely at variance with his professions of careful and long continued architectural study. This inclination was confirmed when I found they had obtained a place in your journal, and would thus fall under the notice of so many interested in the matters they refer to. In putting this design in practice, I shall borrow his introductory paragraph, in so far as it relates to partiality and prejudice, both which feelings so inimical to all fair discussion, I can most candidly disavow.

The Custom House is the first building noticed by Eder—its size perhaps entitles it to such priority. He applies the terms "imposing and magnificent," to this structure. Now any very large mass of building may be allowed to be *imposing*, if of an adequate height, but magnificence implies something more than mere mass of material and extension of surface: it includes, I conceive, a symmetrical arrangement of parts, fine proportions, and a degree and character of ornament suited to the importance and purpose of the building. In these three points I hold the Liverpool Custom House to be most lamentably deficient. First, as to *arrangement* or *composition*. The building is on a plan much like the letter H, the cupola occupying the centre of the cross part of the letter, and a portico on one side of the cross, and on each of the upright parts. The consequences of this arrangement are destructive of all fine perspective effect, for when viewed on its north front, the cupola serves only to destroy the effect (such as it is) of the portico on that side, and seen from the east and west fronts that feature seems hardly to be part of the pile, so completely is its connection with those fronts hidden by the projection of the wings. This cupola (in his opinion, in which every body I imagine must agree with your correspondent), in fact never terminates the perspective from any point of view, nor combines with any of the intersections of the wings and central portion of the mass. With regard to the position of the porticoes, that to the north is buried between the wings, and can never be seen in profile. and its projection is so slight that were it not that the only light it ever receives from the sun falls very much aslant, and consequently gives a great prolongation of shadow, it would have no more relief than a row of attached columns with a pediment over them. The above remarks as to want of projection, apply with greater force to the other two porticoes, which however *can* be seen in profile, or obliquely, though for reasons I shall point out when I come to speak of the *proportions* of the parts, their effect is completely destroyed. The site of this building was well adapted to a cruciform plan, and had such an arrangement been adopted, the porticoes, however deficient in projection and depth, would at least have formed suitable terminations to the several portions of the cross; and the cupola, however foreign to this, so called, Grecian design, would have risen naturally, as I may say, at the intersection, and have terminated the converging perspective of the body and transepts with good results as regards its own effect and importance, and without interfering with the porticoes in those respects. Such a disposition of the plan would also have insured a better distribution of light, and greatly have benefitted the interior arrangements, which as your correspondent justly observes, are sadly wanting in this point. As regards the proportions of the several fronts, and the features which compose them, it seems to me that very little consideration, or consideration to very little purpose has been bestowed on them, more especially as respects those very important parts of the composition, the porticoes. Their projection (for they are all alike) is so slight as to appear nothing in comparison with their frontal extent, and to take away all idea of shelter or shade. I do not know whether Candidus will include expression as one of the banished or obsolete architectural terms, but this quality (for I for one believe in its existence) appears to me to be utterly wanting in three of the fronts. As I wish to advance nothing without endeavouring to give a reason, I shall explain myself as well as I can. I am of opinion, then, that there are two general proportions in which a portico may be combined with a front, of which it does not occupy the whole extent, without loosing its own effect, or interfering injuriously with that of the front of which it forms so material a feature. These proportions seem to me to be firstly, such as shall give to the portico the greater part of the façade, and make the remainder on either side appear as mere adjuncts or accessories thereto; or secondly, such as shall make the portico a subordinate feature in the design, leaving an extended surface on either hand. In the first case the impression on the mind will be (such at least is the effect with myself,) that the front being of a proscribed extent both as to length and height, and a portico a requisite part of the edifice, that portion had been kept within the extreme dimensions of the site for the purpose of preserving to it a fitting proportion as to elevation: and in the second, that the portico being as before supposed a necessary and ornamental feature in the proposed arrangement, had been so proportioned to the whole extent of front as not to destroy its unity and continuity of appearance. The expression of the first named portico, I conceive, will be found that of dignity and grandeur combined with use, and that of the second more allied to comfort and convenience judiciously united with a due regard to ornamental effect. Of the first mentioned proportion I consider the portico of the Fitzwilliam Museum at Cambridge, a good example. As a specimen of the second I may quote that of the India House, inharmonious as that front may be in some of its details. In spite of what I have said above, I still greatly prefer the truly Grecian application of the portico, where it includes the whole front of the building, and continues without interruption or break, save its own angle, the order or entablature, as the case may be, of the lateral portion. But to apply these remarks to the building under consideration.

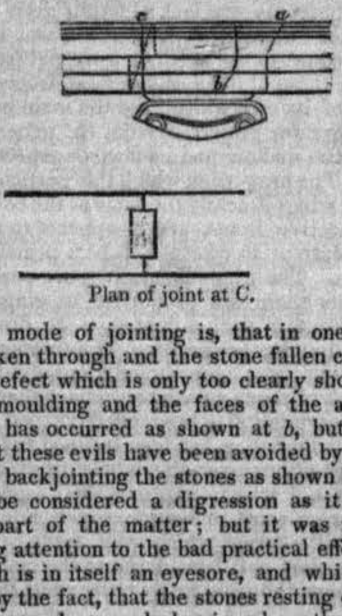
Fig. 1.



The east and west porticoes of the Liverpool Custom House occupy, to my eye, exactly the unhappy medium between the proportions I have attempted to describe; and instead of leaving the mind at rest to contemplate and enjoy their air of simple dignity, or of inviting and hospitable shelter, together with the varied effects of light and shade of which these beautiful architectural features are capable when happily conceived and applied, they distract the eye, both mental and physical, by a puzzling uncertainty as to the meaning of the architect, and by their bareness and lack of depth give no idea but that of useless show, and of an exposed, comfortless, and contracted entrance passage. With regard to the north or principal front, the portico has an advantage over those of the east and west fronts—having in rear a slight projection of its own width from the main building; this gives an appearance of greater projection from the general line, but is of no avail as regards the shallow and ineffective aspect arising from deficiency of depth. The proportion which this portico bears to the whole space between the wings is nearly the same as the two already described bear to their respective fronts, and it appears to me to labour under the same uncertainty as to whether it be a principal or accessory in the general design. The wings themselves are perhaps not too far in advance as respects their own proportion as *wings*, but they unquestionably do stand out to such a degree, as to drown completely the portico and its adjoining projection. The fronts of the wings which consist of openings of three intercolumniations divided by two columns in antis, and a flank of about two intercolumns pierced with windows, on each side, are certainly the most effective and least objectionable parts of the front under notice, but I am inclined to think that a greater height of blocking either over the whole front, or at least over the central portion, would tend to improve their aspect. I come now to speak of the rear or south elevation which Eder describes as "infamously miserable,"—terms which well apply to the whole of the wings on that side, but not, I maintain, to the main front which comprises, in my opinion, the only really redeeming feature in the whole building.

All pretension to Grecian character appears here to have been abandoned. The cornice of the columnar order is, to be sure, continued, but without the frieze and architrave, and being of good projection, with a massive dentil member in the bed-mould, it harmonizes well with the general character of this portion of the building, which is most decidedly Italian. Though I think the central projection of this front is, like those in the others, faulty in its indecision of proportion to the whole, still, in itself, I consider it in all respects much the best part of the structure. It consists of a plain well-proportioned elevation, divided into three parts by two slight breaks. The middle portion of the three is pierced below by three open segmental arches leading through the building to the opposite front; and above these, three semicircular-headed windows of good proportions, and pleasing though simple character. The lateral divisions have above each, one window corresponding with those of the centre; and below, a window recessed in an arch similar to those forming the three openings above mentioned. The front is divided horizontally by a bold string course, and surmounted by a massive but suitably proportioned plain attic wall, with its cornice and blocking. The impost moulding of the upper windows is also carried through, which lightens, without too much cutting up, the massive and substantial piers which divide them. There is a good height of plain wall between these windows and the cornice, which, in my opinion is a great assistance towards gaining dignity of aspect, giving me always the same kind of impression as a lofty forehead surmounting a human face. The solid and void are, I think, very happily apportioned in this front, and though I could wish for a better description of rustic work than the horizontal channels in the basement, still the effect of the whole is simple, substantial, and dignified. Here, and here only, does a cupola, supposing it to be something very different from that which really exists, not appear misplaced. The attic wall hides the roof completely, and conveys the idea of a solid support for the mass above it, and the breaks dividing the front are so proportioned as to carry the eye easily upwards to the plinth or stylobate of the cupola, which falls just enough within their line to give the appearance of a proper degree of stability. In the article of decoration, which I mentioned as the third requisite to fill up my idea of magnificence, the Liverpool Custom House offers but little for our consideration, and the quality of what exists can hardly, I imagine, excite a wish that there was more of it. It is difficult to conceive that Greek details could be applied with a more complete absence of all classical effect and feeling. Unfluted Ionic columns, with fluted tori in their bases, composed each of eleven stones; pilasters with capitals, whose mouldings are certainly copied from Greek examples, and enriched, according to established use, with water-leaf, &c., but which mouldings, alas, project more than three times as far beyond the faces of the pilasters, as the pilasters do from the wall, the projection of these latter being barely 3½ inches to a diameter of 4 ft. 6 in. The projection of the entablature follows, of course, that of the pilasters, and shares in their meagre aspect. In the architraves of the porticoes it appears that stone could not be obtained in sufficient lengths to bear from column to column, and the architect has had recourse to the method of notching shown in Fig. 2.

Fig. 2.



Plan of joint at C.

The effect of this mode of jointing is, that in one portico the part marked *a* has broken through and the stone fallen considerably out of the horizontal, a defect which is only too clearly shown by the broken lines of the tenia moulding and the faces of the architrave; and in another a fracture has occurred as shown at *b*, but not to the same extent. Might not these evils have been avoided by showing a vertical joint in front, and backjointing the stones as shown by the dotted lines at *c*. This must be considered a digression as it belongs rather to the constructive part of the matter; but it was mentioned for the purpose of calling attention to the bad practical effect, of a mode of construction which is in itself an eyesore, and which is enhanced in the present case by the fact, that the stones resting on the columns are almost uniformly some degrees darker in colour, than the intermediate ones which are notched into them. Through some defect, as I imagine, in the foundation, a very serious fracture is visible in the N. W. wing over one of the windows within the recess. But to return to the details; the stylobate so much commended by Eder is a plain square plinth, projecting just sufficiently to receive the bases of the very slab-like pilasters I have described, whose moulding is also, as noticed by your correspondent, carried entirely round the building, with the exception of the south front and wings. This stylobate is certainly much too low to be in proportion to the order—as to the doors and windows, I marvel much what any one can find to admire in them. The windows, except those I have mentioned in the south front, and similar ones under the north portico, are either plain oblong holes, or have a meagre ghost-like architrave, without even the knees or projections at the upper angles to be found in the only genuine Grecian example of such features in the Erectheum. The doors *may* be copied from Greek examples; but who can say that the upright unenriched cyma, is not an ungraceful member? I imagine that the very vertical profile of these mouldings, was adopted in the originals for the better display of the ornamental surface, which decorated them; but as here applied, in their naked state, they are positively ugly. The trusses of the doorways are, to my eye, little less unpleasing, and the nature of the stone and quality of workmanship, give no great effect to what ornaments they can boast. I have as yet said nothing of the interior, or of the details of the cupola. The whole of the former is not yet opened to the public, the fittings of the long room being incomplete. Having had a view of this room, I can only say that it seems to me no great improvement on the exterior. The plan is confused and choked, and the effect of space destroyed by the numerous columns, which, in their disposition, evince a singular disregard to any regular arrangement. The internal cupola, which springs from pendentives rising upon the entablature of the Ionic order of this room, is spacious, and considerably enriched, but claims no notice on any other grounds. On its exterior companion I must decline making any remaiks, as my disclaimer of prejudice might perhaps not avail me, were I to say all I think of it. I believe, however, the original design of the architect was not so utterly tasteless. That part of the interior already occupied is sufficiently and fairly described by Eder, being very dark and inconvenient. I have trespassed long on your valuable space; my excuses are that a great deal of unmeaning, and I think ignorant admiration has been bestowed on this structure, both by residents and visitors; that I have never heard a reason given for any thing which has been said in its favour; that all that is the least good in it seems to have been uniformly overlooked; and that it is one of the most extensive and costly buildings which have been erected in this country of late years, having occupied more than ten years in completion, and having cost, as I have been informed, a sum approaching £400,000. In conclusion, I hope I have said nothing to impugn my opening professions of impartiality. Let those who have seen this building judge for themselves, and if, in comparing these remarks with the original, they consider the objections urged beyond the bounds of just and fair criticism, I hope they will, as I have endeavoured to do, give the reasons which influence their opinions; should such meet my view or that of others who think like me, I hope they will be judged of in the spirit of candour, which I trust has guided my pen in the foregoing observations.

Your's, &c.,
H.

Liverpool, Nov. 9, 1840.

Since the above remarks were written, the Long Room has been completed and opened for business. I have only to add, as regards this room, that, although a vista is preserved through its entire length, the effect is destroyed before one third of that length is traversed, by the confused appearance presented by the columns. This arises from the strange indifference here manifested to regularity of intercolumniation, which is such that, looking on either side of the room, no two pairs (not couples, for there are no really coupled columns, however nearly they approach such an arrangement) of columns seem equally far apart. The coffers of the cupola appear much too shallow, and the mouldings as much too large for the depth of the coffers, though perhaps not so when viewed, with respect to their surface, rather than their depth.

VICTORIA ROOMS, BRISTOL.

Sir—The portico of the Victoria Rooms, Bristol, although correctly placed in the Octastyle Class in the table of porticoes given in the Civil Engineer and Architect's Journal for this month, is therein stated to have five intercolumniations, a contradiction which you may not perhaps think it necessary to explain; allow me, however, to add that there is an important omission in the description of it, as the pediment I am happy to say is sculptured, or more properly is being sculptured, from a working model by Mr. M. L. Watson, the principal relief from the face of the tympanum being 2 feet 3 inches. I shall feel obliged by your attention to this letter.

And remain, Sir, your most obedient servant,
Charles Dyer.

36, *Guilford Street, Nov.* 11, 1840.

ON THE DRAINAGE OF LOW LANDS.

BY MR. WILLIAM FAIRBAIRN.

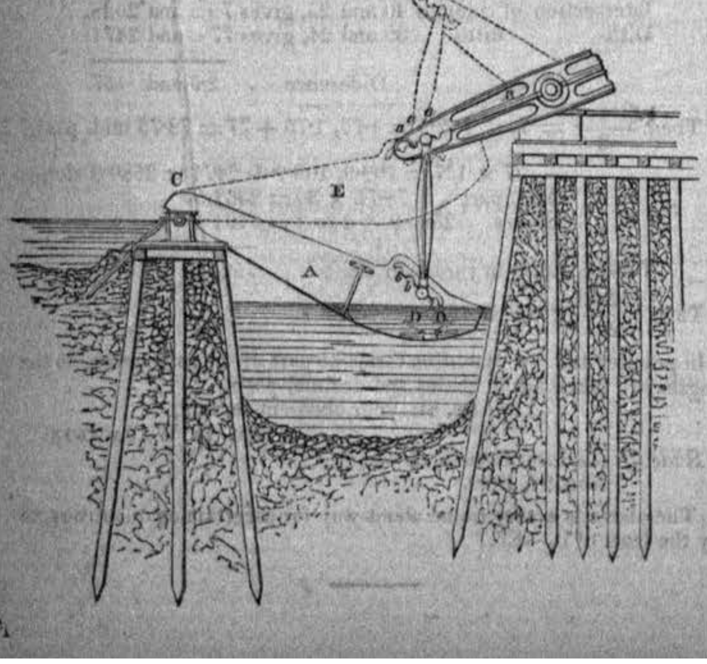
THERE are few subjects of more importance or more deserving of public attention than the drainage of lands. In cultivating land below the level of the sea, drainage is one of the first steps, for unless the superfluous waters of a low marshy district be freely removed and discharged at a level above its surface, it is in vain to look for productive crops, however rich the soil or the alluvial deposit may be.

Hydraulic machines of almost every description have been in requisition for this object, and in countries, such as Holland and the Fen districts of Lincolnshire, where the land is in many instances several feet below the sea, those machines have been extensively used, and many improvements have from time to time been introduced. Formerly windmills and animal power applied to scoop-wheels seem the only methods adopted, but since the introduction of the steam engine a material change has been effected. Engines of great power may now be seen giving motion to wheels of 25 to 30 feet diameter, discharging large quantities of water from the lower to the higher levels.

The scoop-wheel, although a simple and effective machine, is not (according to Mr. Fairbairn's opinion), the most economical for the drainage of low lands. In countries where fuel is expensive, it is an object of great importance to obtain power at a cheap rate, and by the application of the steam engine upon the Cornish principle, a saving of three times the fuel now consumed may be effected. The consumption of fuel by a well constructed condensing engine is from 10 to 12 lbs. of coal per horse power, per hour, or 10 lbs. of coal will raise 2,000,000 lbs. of water one foot high in a minute; whereas a single acting Cornish engine, according to the returns, will raise with the same quantity of fuel 8,000,000 lbs.—a duty four times greater than has yet been attained by the common condensing engine. Taking it, however, at only three times the duty, or 6,000,000 lbs. one foot high in a minute, the saving is even then so great, as to be entitled to the attention of proprietors whose lands are situated at a level requiring the aid of steam to clear them of water.

From these considerations it appeared to Mr. Fairbairn desirable to apply the Cornish engine, and having been requested by parties interested in the drainage of the Lake of Haarlem, to consider the best and cheapest means for the attainment of that object, he proposed a machine, of which the following is a description.

In raising water by the scoop-wheel, it is obvious that a uniform force is necessary to overcome the resistance upon the floats, as they successively discharge their contents from the lower to the higher level. This resistance being constant, the force applied, and the quantity of fuel consumed, will be equal to the load, or to that of a low pressure condensing engine, similarly constructed to those on board of steam boats. The effect produced on the bailing-scoop will be totally different, and instead of a continuous action as exhibited in the common wheel, a reciprocating motion will be produced, and the same economy insured as is now exemplified in the returns of the Cornish engines. In applying this description of engine it becomes necessary to adopt the reciprocating principle, and by raising a weight suspended at the opposite end of the engine beam B, the large bailing-scoop A, revolving on a fulcrum at C, descends to the lower level, and is filled with water through the opening valves D, D. The weight having been elevated to the full height of the stroke, it descends by the force of gravitation, and raises the bailing-scoop to a horizontal position as at E, causing the water to flow over the pivot C, into the level above. The same process is repeated, each stroke by the admission of steam into the cylinders to raise the weight, and the bailing-scoop is again elevated by its descent.



The principal advantage peculiar to this machine, is its adaptation to the single-acting Cornish engine; first, by the introduction of a portion of high pressure steam to overcome the inertia of the weight; secondly, by its subsequent expansion to maintain the momentum; and lastly, by the gravitation of the weight to lift the load; on the same principle, in fact, as the engine at the East London Water Works, under the direction of Mr. Wicksteed, and as those in Cornwall.

The bailing-scoop is 25 feet long and 30 feet wide, composed of boiler-plates, with two partitions to strengthen the bottom and support the valves for the admission of water at D. The machine is calculated to raise about 17 tons of water each stroke, and with an engine of 60 horse power will effect a duty equal to 2½ or 3 lbs. of coal per horse power, per hour. It will be observed that the length of the stroke continues at all times the same in the cylinder, whilst at *a a*, *b b*, &c. it is varied by a series of stops fixed horizontal to the sides of the engine beams, and upon inclined planes on the bailing-scoop. This is done in order to lessen or increase the dip, and to accommodate the lift to a height commensurate with the difference of the levels which may exist between the surface of the lake and the height to which the water has to be raised.

ON THE COMBUSTION OF COAL.

SIR—Having lately submitted to the public an improved mode of introducing air to the gaseous matter of coal in a furnace, by which its complete combustion is effected, and the generation of smoke necessarily prevented; and finding that the principles on which this is produced have been misrepresented or misunderstood by the contributors to some of the public journals, I am desirous, through the medium of your columns, of being set right in the public view on this important subject. In some instances, indeed, the effect produced by my mode is attributed to causes which are the very reverse of the fact, and though evidently by a friendly hand, yet the result is so opposed to chemical truth, that I am unwilling to sanction such an explanation of the principles on which I have effected perfect combustion on the large scale of the furnace.

In the treatise published by me on the "combustion of coal, chemically considered," I have explained the source of those errors into which the patentees of "smoke burning" systems have fallen, by their search after a high temperature, and looking to that temperature as the means of consuming the gas or smoke, to the utter neglect of all that regards the quantity of air admitted to the furnace, or the conditions on which it combines with the combustible. In that treatise I have mainly relied on the fact that the question of effective combustion is a question as regards the *air*, and not the *temperature*. Modern patents have run on the erroneous idea that the gas evolved from coal in the furnace, and from which flame is exclusively derivable, is to be consumed by bringing it into contact with a mass of highly ignited carbonaceous, or coky matter. This I deny, and consider it to be not only a chemical fallacy, but a great practical error. On this ground, therefore, I am unwilling to be considered as regarding the question of a high temperature as the essential to the ignition or combustion of the gaseous matter of coal. My mode of effecting combustion, by introducing air to the gas in the way of numerous jets, depends for success on principles quite distinct from those which are attributed to the action of heated air. By one writer, the effect of my system is stated to be attributable to the circumstance of the air being heated in the passage through the diffusion tubes; now these tubes are used by me for the sole purpose of throwing the air into small jets, corresponding, in principle, to the jet from a blow pipe. This mode of explaining my principle goes neither to the right cause or effect.

So far from the tubes or pipes, which are made of fire clay or cast iron, heating the air in its passage through them, I have proved, practically, that the combustion goes on equally when the tubes are black and cold, and the air passing through them necessarily cold; this cold air, on issuing from the numerous small orifices, conveying the idea of jets of *flame* rather than *air*. It is important to state that I place no reliance on the question of the temperature of the admitted air.

It has been stated in explanation of the effect produced by my diffusion tubes, that as there is always plenty of air, or oxygen, in the furnace, and a deficiency of heat, the introducing the air at a high temperature, supplies this deficiency. This is directly the reverse of what I have stated to be the condition of the furnace, and the flues leading from it. The following extracts from my tract will put this in a clear point of view.

At page 124, I state, "The leading condition of the combustion of the inflammable gases being the *mixture* with the oxygen of the air in given quantities, and at a given temperature, those inventors have in too many instances, to the utter neglect of the former, exclusively directed their attention to the latter,—the obtaining the highest degree of heat, even to incandescence, for the gases. Now this is unquestionably the condition which demands the least attention on their parts, if *any at all*."

Again, page 129, "It is the palpable oversight of the distinction between increasing the *faculty* of combustion, and actually producing that combustion, which has led to that manifest chemical blunder,—the supposing that coal gas is to be *burned* by the act of bringing it into contact with bodies at a high temperature: or, in the words of the patentees, by 'causing it to pass through, over, or among, a body of hot glowing coals.' In our efforts then, towards effecting the combustion of the gaseous products of coals, it is essential that we steer clear of this hitherto unquestioned practice: attending solely to the question of *air*, and all that has reference to its introduction, distribution, and diffusion: for we may take it for granted, that the condition of *heat* is but a secondary condition; and that the required temperature will never be wanting in the furnace, from the moment we '*light the fire*,' if air be supplied in the proper quantity, at the proper place, and in the proper manner: but if these conditions be not satisfied, an accession of heat cannot remedy the evil, however it may aggravate it."

I assert then, that there can be no greater fallacy, than supposing that giving a high temperature to the air admitted, can be the means of effecting the combustion of the gases, or the prevention of smoke. An analogy has been drawn between the effectiveness of hot air in the manufacture of iron—this however bears no analogy with the introduction of hot air to the furnace, as the means of effecting combustion or preventing smoke. With your permission I propose considering this point on a future occasion—at present I confine myself to denying the assertion that my plan obtains any advantage from the circumstance of the air being heated in its passage into the flues through the small orifices of my diffusion or distribution tubes.

I am, Sir, your's, &c.

C. W. Williams.

Liverpool, Nov. 20, 1840.

THE NELSON MONUMENT.

Sir—Since I last addressed you, the first stone of the Nelson Column has been laid, the work is progressing rapidly, and will continue to do so until the public rise en masse to protest against so great an outrage upon the principles of beauty, or, peradventure, the subscriptions be, as at present, insufficient to complete the structure. We shall then have a piece of a column, to show succeeding generations the lofty standard of beauty amongst us, and to point out how *we* delight to honour the great, the virtuous, and the brave. Shall we, the British nation, permit this living libel to appear against our love of art; glorying in the matchless works of our ancestors, shall *we* allow posterity to point with derision to the evidence of their effect upon us. Enough has been said to show that the Nelson Committee are alone in their project, and it will be disgraceful, if the public submit to have this column thrust upon them, in opposition to their better judgment. Those journals in which we place most confidence in matters of taste, the Athenæum, the Literary Gazette, and the Art Union, have all protested against the proposed column; but despite this and the positive opinion of the Select Committee of the House of Commons, the projectors pursue their object *per fas aut nefas*, and the stone which Wellington would have been proud to lay, is laid, with no public announcement, and no popular enthusiasm, by the Secretary of the Committee. We do not hesitate to say, despite the expression of condemnation upon the whole building, that the *portico* of the National Gallery, exhibits many architectural beauties in its internal columns, and the depth of shadow caused by the projection of the antæ in front of the wall, and it is the portico which the pedestal of the column will completely hide. With all deference to one whose opinion as to the good effect in juxta-position of colossal, and ordinary proportions, demands from all, the highest respect, I would beg to notice that St. Peter's at Rome, has been objected to on account of the enormously disproportio figures lessening the effect of the architecture, and St. Paul's itself, for the difference in size of its two internal orders. Sir F. Chantrey in his evidence as to the effect of the column as an ornamental object, says, "the Trajan, the Antonine, and the Napoleon columns are the only monumental objects of this class that I have ever looked upon with entire satisfaction; I read the history of the man on the shaft of the column, and the mind is thus reconciled to see the statue so elevated. I may be told we have not money enough for a work of this character, that naval exploits furnish bad materials for sculpture, or that the arts of this country are in too low a state to accomplish so noble a work; then I say, abandon the impossibility at once, and try something more in keeping with our means and our genius." The "general observations by T. L. Donaldson, Esq.," contain opinions as to the bad effect of a naked column. If, therefore, it can be shown, not that the funds do not suffice to enrich the shaft with bas-reliefs, and crown the column with a statue of bronze, but that the subscriptions are actually inadequate to complete the denuded shaft and the perishable statue, and if in addition to these sufficiently cogent reasons it can be proved, that a colossal column, when used without the structure of which it is as much a part as the leg is of the man, is an outrage against our most cherished principles of beauty,—it becomes the people to protest loudly and speedily against the infliction of so great a national indignity.

I am, Sir, your obedient humble servant,

A Lover of the Beautiful.

36, *Tonbridge Place, New Road,*
November 20, 1840.

ON COMPUTING EARTHWORK.

Sir—Observing an article in your October number, page 334, on the methods of computing Earthwork, by Mr. S. Hughes, in which the writer asserts, that the tables of Messrs. Macneil and Bidder, "are useful only for calculating sections where the scale is very small, and where the heights cannot be taken otherwise than in feet—and that where the scale is sufficiently large to show the heights in feet, and decimals of a foot, they are of no use." I take the liberty of transmitting to you the following for the purpose of proving that the tables of Messrs. Macneil and Bidder, are as useful for such calculations, where the heights are in feet and decimals, as in feet only.

I have at present the tables of Mr. Bidder only at hand, although I constantly make use of Mr. Macneil's for similar calculations, but an example based on the tables of the former gentleman will be equally illustrative of the use to be made of those of the latter.

For my purpose I have selected the same example as Mr. Hughes, in page 336.

Example.—Suppose a piece of cutting or embankment 39·8 feet deep at one end, and 24·6 at the other end, the base or top 30 feet and slopes 2 to 1, required the area, which being multiplied by the length, shall give the true content.

			Mid. part.	Slopes.
Intersection	of columns	40 and 25, gives	79·5 and	2628.
Ditto	ditto	39 and 24, gives	77 and	2471.
		Difference	2·5 and	157.

$$\text{Then } \frac{\cdot8+\cdot6}{2}=\cdot7,\ \cdot7\times2\cdot5=1\cdot75,\ 1\cdot75+77=78\cdot75 \text{ mid. part,}$$

$$\cdot7\times157=109\cdot9,\ 109\cdot9+2471=2580\cdot9 \text{ slopes.}$$

Mid. part $78\cdot75\times30=2362\cdot50$
Slopes $2580\cdot9\times2 \text{ to } 1=5161\cdot8$

Total contents in yards per chain 7524·3.

$$\text{Then } \frac{7524\cdot3}{22}\times9=3078\cdot18 \text{ correct area.}$$

In practice the last operation forms no part of the calculation, as the lengths are taken out in chains and decimal parts.

I remain, Sir, your obedient servant,

Geo. B. W. Jackson.

Radcliffe Terrace, Goswell Road.
Nov. 24, 1840.

[The above is a very round about way for ascertaining quantities, to say the least of it.—Ed.]

RAILWAY MANAGEMENT.

SIR,—Before railways can ever be expected to be properly managed, several important alterations must be made in the present system. In the first place, the Directors must effectually suppress the propensity to *amateur engineering* on the part of the "clever practical men" of their body, of whom all boards have more or less. In the next place, they must make a common sacrifice of all patronage and personal consideration in the appointment of persons to situations, when any neglect would be likely to be followed by danger to either life or property. Were this system to be fairly and honestly acted upon, I have no doubt the necessary result would be the appointment of an individual, to whom would be confided the *entire* and *uncontrolled* management of the whole of the *out-door* business of the railway. To him would be committed the whole charge of the selection, employment, pay, and superintendence of every engineman, fireman, guard, porter, rail-layer, and labourer on every part of the line, any of whom he should fine, punish, or dismiss at his pleasure, and on him, and him *alone*, should rest the responsibility, both with respect to the public and the Directors, of every hindrance or accident which might occur. In proportion to the success of his management he should be paid, and on his appointment it should be distinctly intimated to him, that in the event of his being found unfit for his office, or even *unfortunate*, no hesitation or delicacy would be observed with respect to his dismissal and the appointment of another in his room. Any person aware of the importance of the duties which would devolve on an officer of this description, would at once perceive that they could not be properly and efficiently fulfilled without his *constantly traversing every part of the line*, and by personal inspection and observation, making himself intimately acquainted with the respective abilities, character, and disposition of every man employed under him, obtaining accurate knowledge of the varying circumstances of the traffic, and of those parts of the railway, where danger was most to be apprehended, and by the foresight which, by this means, he would be enabled to exercise to prevent the confusion and accidents with which the present system is so rife. The influence, moreover, which an officer of this description would exercise over the men, would be instantly visible in their guarded and more careful conduct, the well disposed from a hope of reward or promotion, and the bad from the fear of detection and punishment. Energy, perseverance, and tact, combined with sobriety and habits of business, would be the chief requisites in his character. It would also be essential that, in addition to his being an experienced engineer, he should be *practically conversant* with the nature and details of every man's employment, especially that of the engine-men, as a more self-important and uncontrollable set of men do not exist, if they have reason to think that those who are placed over them are not perfect masters of their craft.

The first thing to which I should suppose a person placed in this situation would direct his attention and instantly prohibit, is the very common practice of making use of either line while travelling in the same direction, a practice so obviously fraught with danger, that I am astonished how any board of directors or superintendant can, for a ment, allow it, except under the most extraordinary circumstances, and most stringent and well defined regulations, whereas, on the contrary, there appears to be no instructions whatever on this important point, nor any farther discretion exercised in the practice of it, than such as the circumstances of the case, in the opinion of those present, seem to require. Indeed, throughout the whole system, the absence of *individual* and *responsible* management is glaringly evident, and in all cases of danger and emergency, every one seems to "do that which is right in his own eyes."

Then as regards the signals, there is a red light for danger, a green light which indicates neither "danger or safety," and a white one which it would appear means anything or nothing, as the engine-man can best make out, all of which are confided without check, and almost without instructions, to ignorant, forgetful, and sometimes careless men. Can any reasonable person for a moment expect, that with a complex and ill-defined code of signals like this, railways are likely to be free from danger, or would he not rather express his astonishment, that so *few* accidents should have happened. If the road *is* perfectly clear, what necessity is there for any signal whatever, if it *is not* so, what need of more than one? Instead of all this complexity, I would at once adopt the broad and intelligible principle, that *a signal of any kind, exhibited under any circumstances*, should *always indicate danger;* and in order to carry it out, I would render it imperative on *every train* to have a light in *front* and one *behind* from sunset to sunrise, placed at such a height from the ground that persons moving about could not intercept the view. *Similar lights* should be exhibited during the same period at all the stations, placed at the *same height*, and occupying the *same relative position*, as those in the trains, so that an engine-man could not be certain, on seeing the signal, that it was not a train in his way. But the improvement to which I should be disposed to attach the most importance, and from which I should anticipate the happiest results, would be to place the whole of the station signals on a machine, which should be so far self-acting as *always, when left to itself, to indicate danger*, and to *require an effort* on the part of the attendant, before that warning could be removed; from this very simple precaution would be derived the important result, that *neglect of* or *inattention to* the signals would *insure safety*, which is sufficiently evident, as, whether danger did or did not exist, the signals would always indicate it, and cause the coming train to step until it should be removed. There are many more points connected with railway management, which are by no means brought to the greatest degree of perfection of which they are capable, but for the present, I will leave them for a future communication, should it be necessary.

I am, Sir,
Your's very respectfully,
A RAILWAY ENGINEER.

November 24, 1840.

REVIEWS.

Papers on Iron and Steel. By DAVID MUSHET.

(THIRD NOTICE.)

Continuing our remarks upon the subject of iron, we may remark that the ores from which the metal is derived are distinguished by the author into two principal classes, primary iron ores and iron stones. The primary iron ores are defined to be those found in the older formations, bearing little resemblance to those in the stratified planes, and have, in Mr. Mushet's opinion, been formed by secondary agency, although they differ widely from each other in their properties. Some are distinguished as being obedient to the magnet, and others the reverse, but this property is by no means dependent upon the quantity of iron contained in the ore, but on its being in the state of protoxide, united or not with a portion of peroxyde, as ore from the Isle of Elba yielding 70 or 80 per cent. is but slightly affected by the magnet, while many of the Norwegian and Danish ores with only 18 to 30 per cent. of metal are highly magnetic. Mr. Mushet well defines the magnetic property as a test rather of the presence of iron than of the probable quantity to be obtained. The principal localities in England for primary iron ores are Cumberland, and Furness in Lancashire, also in the island of Islay, Muirkirk, and other places in the north, Cornwall, Devon, &c.

The Cumberland ores which present a perfectly formed crystal seem to be formed by the agency of water, an opinion which is countenanced not only by the structure but by several remarkable circumstances, water having been found in cavities of this ore, which had been transported several hundred miles. This ore is generally found, as well as that of Furness, in caverns or churns of the mountain limestone in large masses, splinty and globulated, consisting of various kidney terms called hæmatites, striated and smooth, of bluish and reddish colours. The Lancashire ore is composed of smaller masses, softer and of a more greasy appearance, but highly crystalized. Both of these ores, in the kidney variety, contain fine specimens of graphite or fossil plumbago. The ores both of Cumberland and Furness are much sought after for the purpose of mixing with poorer ores, large quantity of the Furness ore being shipped from Ulverston for South Wales. An opinion has prevailed unfavourable to the working of these ores on the spot, where both coal and limestone are at hand; no effective method of reducing them having yet been employed, although the author of the work before us has on more than one occasion given his weighty testimony as to the practicability. The Islay ore is found regularly stratified, and resembling, in point of deposition, the Norwegian and Danish ores. The strata, as described, are almost vertical, and are found imbedded in a loose ochreous earth surrounded with soil. The ore is not smelted with advantage owing to the excess of silex it contains. In different parts of Scotland, in the West Highlands, at Muirkirk, Salisbury Craggs, La Mancha, Cranston, the Ochil hills, &c., small quantities of ore have been found, but no quantity sufficient to justify the working. The chief Cornwall ores found in the granite are those of Lostwithiel, much mixed with quartz and manganese, and averaging about 48 per cent., and those of Fowey, a brown hæmatite, with 58 per cent. Those of Devon are the ores of Haytor, containing about 45 per cent. and lying in a schistose formation. We may also notice here the alluvial Minehead, in the new red sandstone, yielding 44 per cent., and at Brixham, yielding 62 per cent. The Devon and Cornwall ores are used extensively in South Wales, as also a rich hæmatite from the neighbourhood of Bristol, containing from 45 to 60 per cent. The iron of ores of the Forest of Dean are found like those of Cumberland in the carboniferous limestone; brush ore is one of the principal varieties, a hydrate, with protoxyde of iron, containing frequently from 60 to 65 per cent. of iron, the leaner ores containing a great deal of calcareous matter in the shape of spar, and so yielding only about 15 or 25 per cent. The Forest of Dean ores are the only ores worked alone, and instead of being treated with limestone, require a mixture of burnt argillaceous schist, as on account of their containing limestone, they are refractory and infusible.

We now come to the iron stones—these are commonly found in horizontal strata, subject to the same acclivity and declivity as the other stratified substances under the surface; their inclination varying according to the nature of the ground, and the disposition of the incumbent strata. They are supposed to be of aqueous origin, and are generally found imbedded in schistous clay more or less compact, which moulders away on being exposed to the atmosphere, and frequently accompany coal and limestone, in immediate contact with the coal. The ores are of two principal forms, in strata from half an inch to twelve inches thick; regularly connected strata called bands, and strata of detached stone found in distinct masses, from the size of a small shot up to a weight of several hundred pounds. The smaller masses being called in Scotland ball stones, and the larger lunkers (qy. lumpers). Band ironstone accompanying limestone is most commonly of inferior quality, its component parts being chiefly calcareous, and the quantity of iron contained being small, while ball iron stones accompanying lime are of much superior quality. The iron stones are divided by Mr. Mushet into four classes. 1. Argillaceous ironstone, which has clay for its chief component earth, and this clay comparatively pure and free from sand. 2. Calcareous ironstone, possessing lime for its chief mixture, and this lime also comparatively destitute of sand. 3. Siliceous ironstones, uniting clay and lime, and containing large proportions of silex. 4. Mixed ironstone, containing nearly an equalized mixture of clay, lime and sand. Each of these classes requires a different treatment dependent on its constituent parts, which with the quality of the fuel are the causes of the great diversity of processes which prevail in the manufacture of iron. Besides these four classes must be mentioned the Mushetstone or Blackband, a carboniferous ironstone, partaking much of the nature of coal as generally it contains carbonaceous matter enough to torrify the stone and make it fit for the furnace. Its exact geological position has not yet been determined, but is supposed by its discoverer to be in the lower part of the coal field near the millstone grit. The usual criterions by which ironstone is judged are—1, the degree of tenacity with which it adheres to the tongue after torrefaction; 2, its colour; 3, the obedience to the magnet when pulverized; 4, by depriving of its iron a given weight of the ore in the assay furnace. The first and third of these methods are peculiarly liable to error, as the degree of adhesion to the tongue will be more in proportion to the quantity and kind of clay contained in the stone, than to its real contents of iron, and the influence of the magnet as before remarked, is equally deceptive. The test by colour, although an empirical method, is one far more to be depended upon. A correct chemical analysis, however, although the surest test, is scarcely ever used, from the ignorance of the manufacturers. Mr. Mushet complains loudly and truly of the deplorable state of scientific knowledge of this class, which is as slow in acquiring instructions as in adopting improvements. He asserts that to his own knowledge the grossest mistakes have been made, and cites one case of iron ores of 30 per cent. having been sold for and smelted as ores containing 60 per cent. Detection it appears in such cases is difficult, as the charge of the furnace often consists of an association of iron ores, iron stones, and scoria from the forge and mill. Nor does the case appear to be much better among those professing some knowledge, as from want of proper instruction they are also open to gross errors. Instruction of this kind therefore seems to be a legitimate object in schools of mining and engineering, the inculcatiob of which would be of more good than all the attempts at teaching practice by theory.

A Practical Treatise on Locomotive Engines. By the Comte de Pambour. London: J. Weale, 1840.

We feel much gratification in being enabled to recommend to the notice of those of our readers who are interested in the theory or practice of locomotive endgines, a second edition of this excellent and truly valuable work. The former edition, although conveying, in the form of experiments, more practical information relative to locomotives than any other work which has appeared on the subject, and embodying the results of those experiments in a theory, which, though no perfect, was nevertheless calculated by the soundness of the reasoning in general, to throw much light on the true theory, was still defective in several points. The resistance of the air to the motion of the trains, and that of the extra pressure of the waste steam on the back of the pistons, caused by the blast-pipe, did not enter into the evalution of the work done by the engines. To supply these deficiencies, the author undertook, in the month of August, 1836, some experiments on the Liverpool and Manchester Railway, from the results of which he has deduced formulæ for determining those quantities which had previously been neglected in the calculation of the resistance overcome.

These experiments comprise also several other researches, such as the vaporization of boilers in different circumstances of rest and motion, the effects of different proportions between the fire-box and the tubes on the total vaporization of the engine, and on its consumption of fuel, &c.

In the first edition the loss of steam by the safety valves had been very incorrectly measured; this has suffered a material alteration in the edition now before us, but how far the new determinations are to be depended on, remains yet to be proved. It is an investigation which demands that the experiments should be conducted with the utmost nicety, and in the greatest possible variety of circumstances.

The table of experiments on the quantity of water carried over with the steam in the liquid state, differs in some respects from that which was published in our Journal for December, 1839, and to which we appended a note explaining our reasons for not putting implicit confidence in the results obtained. Two different experiments with the Star engine have been substituted in the work under consideration, for those contained in the table which was published in the Journal, and in all the other experiments which are the same as in that table, we observe that a different deduction has been made for the loss by blowing through the safety-valves during the ascent of the plane. The first of our objections is removed by the indirect statement that there was no loss by leakage during the experiments given in the table, the second in some measure by the corrections in the determination of the loss through the valves, and the last by the declaration, that the mean is only intended to be adopted approximatively for engines that have not been directly submitted to experiment in this respect. This mean has been corrected from 0·68 to 0·76.

The second chapter, which treats of the laws which regulate the mechanical action of the steam, is the same as the corresponding chapter of the "*Theory of the Steam Engine*," by the same author, which was published last year. It has been introduced here in order to save the reader the trouble of recurring to another work, besides which, it has the advantage of rendering unnecessary the purchase of that work to those who are only interested in steam engines in as much as they are applied to the purpose of locomotion on railways, and whose means may be too limited to justify such an addition to their libraries.

We are compelled, for want of time, to postpone a more particular examination of this very interesting work until next month, in the mean time assuring those of our readers who are desirous of making themselves more thoroughly acquainted with the effects of locomotive engines, that they cannot do better than possess themselves of this second edition of Comte de Pambour's Treatise; for those who were unable to obtain the first edition, will be amply recompensed for their disappointment, by the superiority of the new one, and those who possess the former, will find it almost equally necessary to purchase the latter, since it can scarcely be considered as a reproduction of the same work, but almost rather as a continuation of it, so many and important are the corrections and additions which have been introduced.

REPORT ON THE REMOVAL OF THE WEIR AT THE BROOMIELAW BRIDGE, GLASGOW.

By William Bald, F.R.S.E.. M.R.I.A.. &c., Engineer of the Clyde.

To the Trustees for Improving the River Clyde and the Harbour of the City of Glasgow.

My Lord, and Gentlemen,

In conformity with the remit transmitted to me, dated the 6th instant, I have read over the Report of Captain Johnstone and Mr. Russell, Harbour Masters. It has been drawn up with great care; and from the facts therein stated, is of great value, and merits deep attention. I have no hesitation in signing their report, so far as it treats of the many advantages which would arise from the opening up the spaces between the bridges for the accommodation of the small steamers, sailing craft, &c. But there are other points, in my opinion, of vital importance, connected with this subject, which have not been mentioned in their report; and which I beg leave to lay before your lordship and the trustees.

The removal of the weir at the Broomielaw Bridge, and the deepening and clearing of the space upwards to Stockwell Bridge, containing nearly 14 acres, would give much additional tidal water; thereby increasing the currents not only through the harbour, but also, to some extent in every part of the Clyde downwards; thus aiding and assisting that scouring force which acts so powerfully in freeing and keeping clear all river estuary channels from banks and shoals—the great obstacle to navigation. In the improvement of the navigation of tidal rivers, no expense or pains should be spared to increase this scouring force, arising from that uniform and constant tidal flow and run of currents ascending and descending alternately, and which are so eminently distinguished by their beneficial effects in preserving navigable channels, as compared to those violent land-floods, which, in many instances, so frequently carry down immense masses of matter, forming shoals, banks, and bars in them, extremely injurious to the navigation, and involving great expense in keeping them clear.

The removal of the Weir at the Broomielaw Bridge, and the additional receptacle for tidal water between the Bridges, would have a tendency to sweep and scour away all those impurities which are at present discharged into it by the city sewers. The removal of the weir, and the deepening and clearing away of the channel of the river, would also have the effect of lessening the miasma which arises from the present condition of the bed of the Clyde between the bridges, and would render the atmosphere of that part of the city much more pure and healthy.

It is noble and praiseworthy to erect hospitals and asylums for the relief of those who may unfortunately be afflicted with fever; but how much more advantageous would it be to cut off and destroy the sources from which that contagion arises, by the removal of all offensive matter? In this respect, the attention paid by the Dutch to many of their cities and towns, offers an excellent example to the people of other countries.

At present, the harbour of Glasgow is a receptacle, not only for a large portion of the *debris* which the Clyde sends down during floods, but it is also a reservoir for almost the whole of the matter discharged by the city sewerage. The quantity delivered into the present harbour from those two sources is immense.

The flood of last August left a deposit on the steps of the upper ferry-stairs, on the south side of the harbour, as follows:—On the upper step, reached by the flood, a depth of 2 inches; on the descending steps, 2⅛, 2⅜, 2⅝, 3⅛, 4¾, and 5 inches. The last step was about 3 feet 4 inches below ordinary high water line. It has been alleged, that the River Clyde leaves little or no deposit; but the above facts prove the fallacy of such a statement. Besides, no experienced observer could have a doubt on this subject, who has seen the extremely discoloured state of the water of the Clyde during a flood, by the quantity of alluvium held in suspension, and which is deposited in the bed and sides of the Clyde, wherever the tranquillity of the water is not disturbed by a current sufficient to carry it away;—and it should always be recollected, that, in the improvement of the navigation of a river, and the widening of a harbour through which it runs, a velocity of 3 inches per second at bottom will work on fine clay; that 6 inches per second will lift fine sand; 8 inches per second, sand as coarse as lintseed; 12 inches per second will sweep along fine gravel; 24 inches per second, gravel one inch in diameter. These established facts ought to govern the engineer as to the width which should be given to rivers, and to harbours through which rivers flow, so as to regulate the velocity of the water and prevent them from being silted up with alluvial matter, or involve a serious expenditure in keeping them clear by the artificial means of steam-dredging; therefore, no exertion or expense should be spared to increase the natural force of the scouring power, by the descending currents through river harbours and river navigations.

It may be observed, that to keep the harbour of Glasgow clear, and sufficiently deep for vessels sailing out and in, requires at least the power of two steam-dredges constantly working; the annual approximate expense of which is as follows:—

Expense of one dredging-boat per annum, including repair of wear and tear, and interest on capital, at . .	£1368	9	4
Steam-power drawing the punts	500	0	0
Discharging the material and carrying it away . .	1200	0	0
Expense of one dredging-vessel . . .	£3068	9	4

Then, the annual expense of two steam dredging-vessels will be about £6,136 18*s*. 8*d*. The area of the wide part of the harbour between Messrs. Todd and Higginbotham's mill, and the Weir at the Broomielaw Bridge, is about twenty-one acres, which requires to be operated on constantly by two steam dredging-vessels: this is nearly equal to the rate of 300*l*. per acre of harbour surface per annum.

Immediately below the Weir, and within the Port, spaces have been cleared and deepened to 10 feet below low-water line, but which have been filled up in the short period of a few months to 2 feet above it; thus filling up a space of 12 feet in height. Looking at the vast expense of keeping the harbour clear—and again, at the great inconvenience to the shipping by a reduced depth of water, arising from shoals and banks being so rapidly formed within it, so extremely detrimental to its free navigation—I am impressed with a more full conviction, that the most active and the most energetic steps should be adopted to diminish those evils as far as practicable. Therefore, the clearing away immediately of the Weir at the Broomielaw Bridge, the widening of the mouth of the Harbour, and the deepening of the River up to Stockwell Bridge, would tend partly to remove the evils here stated, because those operations would increase the tidal currents through the harbour, and equalise them at its mouth.

The matter discharged from the city sewers on the north side into the harbour, might be entirely removed by the construction of a large sewer, commencing near the Jail, and running parallel with the river down to below Barclay's Slip, where it would enter the Clyde. This sewer would receive the whole of the drainage which at present falls into the harbour from the city of Glasgow on the north, and would consequently free the port from considerable deposits which are discharged into it.

The peculiar construction of the present harbour of Glasgow, with its narrow entrance, its head barred by a stone weir extending across from side to side, over which the high tide only sometimes rises but a few inches, so that there is scarcely any perceptible tidal current upwards through it during the whole period of flood tide, until the water has reached above the top of the weir at the Broomielaw Bridge; the water sent up by the tide of flood, as well as the river water descending and falling over the weir into the harbour, remains in a quiescent state, except during the times of floods. Thus, the alluvium contained in the descending waters of the river, the silt carried in by the city sewers, and the fine particles of matter held in suspension by the tidal water flowing up—all meet in the harbour of Glasgow—at every tide, forming immense deposits, undisturbed by any tidal current for more than four hours; which fully accounts for the rapid manner in which the harbour of Glasgow silts up, and the great expense which is constantly required to keep it clear and open by steam dredging-vessels. But if that part of the river between the Broomielaw Bridge and Stockwell Bridge, were deepened, it would receive the river *debris* before it could reach the harbour, and it could be dredged up there as cheaply as any where else, and without any inconvenience to the shipping.

What can be compared to a fine navigable river flowing free and unfettered, without lock or dam, through a city, laying open, by its upper reaches, the rich mineral wealth of the interior country to the enterprise and industry of the people; while, on the other hand, the lower reaches of the river waft the ships to the ocean, that highway to all the regions of the world!

It must be manifest to any person who has observed the immense business which is carried on by small craft, on the waters of the Thames at London between the bridges, on the Seine in Paris, and on many other rivers which run through cities and towns, and the clearing away of the weir at the Broomielaw Bridge, and making the river Clyde navigable through the city, would be a work of the greatest public utility, conferring advantages of the most beneficial kind, not only on the shipping interests, but also on the whole population of Glasgow.

The Govan Railway delivers at the harbour of Glasgow annually from 60 to 65,000 tons of coal; and although this railway will, in my opinion, continue to increase in its traffic, yet I am confident that the opening of the upper navigation of the Clyde would be the means of sending down by water considerable quantities of coal and other minerals, &c. to the shipping in the harbour; and it may be observed, that the descending tidal and river currents—a power which costs nothing—would offer every facility to the transmission of coal and other articles downwards, which could be shipped at once from the barges or punts into the ships and steamers lying in the harbour, without encumbering and occupying so much of the quays, or wearing the streets by the constant cartage of such vast quantities of coal, which are not only required for exportation, but also for the supply of the numerous steamers on the Clyde, and those plying to the ports of England and Ireland. Coal-lighters, carrying about 100 tons, descend the Mersey, enter the docks of Liverpool, and supply the shipping. The facilities to river navigation which the Clyde offers, from the harbour to a considerable distance above the city, into the coal and iron districts, are extremely inviting for the carrying on of a similar traffic.

The space, as already mentioned, between the Stockwell and Broomielaw Bridges, contains an area of nearly 14 acres. The deepening and the construction of wharves within it, would be less expensive, and would afford comparatively more accommodation to the small shipping craft, than any other place which could be found anywhere within the vicinity of the harbour. The expense of the contemplated works will be nearly as follows:—

Masonry, in wharves and quay-walls, 1350 feet long .	£17,287	11	6
Deepening channel, paving, cranes, pauls, &c . .	8,047	17	0
Securing Stockwell Bridge	1,234	11	8
Total	£26,570	0	2

It may be proper to observe, that the deepening between the bridges to two feet below low water line, will not, in my opinion, disturb the foundations of the existing quay-walls in the harbour.

In concluding, it is to be hoped that the space between the Broomielaw and Stockwell Bridges, which is now waste and useless, without a raft of timber, or even a small boat, to adorn its surface, will very soon be covered with numerous classes of small vessels, presenting a scene of a busy maritime trade nearly in the middle of the city. And now that railways are about to compete with the steam-boat passenger trade, what immense advantages would it confer on the steam navigation of the river, if the weir were removed, thereby enabling the steamers sailing to all the lower parts of the Clyde, to arrive and take their departure from between the bridges, or even from the Broomielaw Bridge, which would be so extremely convenient and central to the inhabitants of the city.

BRITISH MUSEUM.—FUNEREAL MEMORIALS OF ROME.

(From the Times.)

THERE are, perhaps, few rooms in the British Museum whose contents deserve or attract more inquiry and observation among the generality of its visitors than the one appropriated to the funereal memorials of the Romans, and of which less account is given in the meagre synopsis of the institution; the other remains of Grecian or Egyptian antiquity which fill its halls, although possibly placed with sufficient taste and judgment, yet having no connexion with the scenery, if it may be so called, of the localities in which they are contained necessarily lose much of the effect they are calculated to produce. To the artist who contemplates the beauty and boldness of their designs, or the excellence of their execution, and takes them as models for his study, this is perhaps scarcely felt; his taste may discern their value; like the lapidary, he is equally aware of the brilliancy of the gem when it first meets his view, whether disguised by the crust that nature gave it, or set off with all the splendid adjuncts which art or study can devise. Still, even the genius of the artist may become cramped and clouded in its development from contemplating the master-pieces of antiquity isolated and unconnected from the architecture to which they appertain, and when, instead of viewing them as part of a magnificent whole, he sees them but in a state of chaotic vagrancy and isolated decay. In contemplating the minutiæ of beauty displayed in the dilapidated or even in the more perfect remains of antiquity, apart from the designs of which they form but a portion, the imagination necessarily becomes concentrated and confined by that which it contemplates, and however much the taste of the observer may be improved, and however excellent may be the work he in consequence produces, yet in his productions that sense of unity and grandeur of thought is often found wanting, which is the distinguishing feature of ancient art. To this, perhaps, may be attributed those anomalies of design which are to be seen in almost all the classic monumental sculpture of our cathedrals, and also in most of the modern architectural elevations of the Greek and Roman school. The different parts or sections of one or the other will often be found perfect, but few there are that taken as a whole will bear comparison with the edifices or monuments of antiquity. We mention this, because, in the chamber we are about to describe its architecture and decorations, with the exception of the northern side, form a perfect representation of a Roman columbarium, or place of family sepulture; the urns which are in the niches of the walls originally occupied similar positions; the sculptue of few of them possesses pretensions to excellence, and had they been placed in a room among a generality of sculptures, they probably would have caused no observation, or if any, contempt; yet in this chamber, fitted up in resemblance of those in which they were found, they acquire consequence, and well worthy are they of the observation they attract. It is the only part of the Museum in which the sculptures are in connexion with the edifice, and which, from that connexion, give a true idea of the purposes for which they were designed; in the contemplation of them the spectator, without much stretch of imagination, might almost fancy himself in a family sepulchre of ancient Rome, surrounded by the ashes of its members.

This saloon is entered from a door in the northern side of the statue gallery; it is 16 feet in length by 10 in breadth, and the height 10 feet; the roof is vaulted and divided into compartments; the colour gray. On either side, cut in the depth of the wall in lines one above the other, are niches, in which are placed the funeral urns of a family, and on the pavement on the eastern and western sides are some of greater magnitude, and also some smaller ones placed on votive altars; almost all of them are richly sculptured, and the various designs have an allusion either to the mythological dreams of the ancients, or represent some domestic scene: none of them possess that character of awful simplicity which distinguish the last receptacles of our Gothic ancestors. Beneath some of the niches are marble tablets, bearing inscriptions, and where this is the case within the thickness of the walls are enclosed earthen jars, with covers, in which the ashes of the deceased were placed. The floor is formed of Mosaic.

The niche No. 35 contains a sarcophagus, on the front of which the marriage of Cupid and Psyche is sculptured. Of this Apuleius gives the following description:—"The bridegroom in the centre is lying on a couch, Psyche '*græmio suo complexus;*' Jupiter and Juno are in the centre behind in a sitting posture, and all the gods according to their rank are standing around; a bowl of nectar is passing from one to the other. Jupiter has a particnlar cupbearer to himself to attend and fill. Bacchus waits on the others, while Vulcan cooks the supper; the loaves are strewed with roses and other flowers, and perfumes are scattered over all by the graces: '*Musæ voce canora personabant!*' Apollo sings to the lyre, while Venus dances in time to soft music, and the graces sing in chorus; the pipe is blown by a satyr, and Pan plays on the reed. The whole of this is a representation of the rites by which Pysche is conferred on Cupid." In this piece of sculpture the principal figures shown are Cupid and Psyche, with their immediate attendants; they are sitting on a couch, in front of which is a small tripod table, on which is a fish; around are the attendants playing on musical instruments in honour of the bride, and bearing to her wine, fruit, and presents: the companion of each of these attendants is represented as a Cupid or a Pysche, for the ancients had many Cupids and more than one Psyche. The ends of the sarcophagus are rounded, the length of it is 4 feet 6 inches, the breadth 18 inches, and the height 15; it was brought from Rome.

No. 33 is a sepulchral urn of an oblong form: three fluted spiral columns and two pilasters divide the front into four compartments, in each o is a door ornamented on the top with pendant garlands of laurel; there four tablets passing across the upper part, one of which has the following scription on it:—"2 C. Magio, F., Pal. Heraclidæ V. A. xviii.;" the othe are blank. The lid resembles those found on the Etruscan tombs; it is li two lids joined together lengthways; in the centre is an ornament of a rabl feeding on fruit from a basket, on each side of which ornament is a de which a serpent and a dog are attacking in front and rear. The doors a supposed to be the portals of the abodes of departed spirits, they are remarl able as having their pediments of the shape generally chosen for the covers sepulchral monuments. At the end of the urn are two spears crossed, whic probably had some allusion to the youth to whom it is dedicated, who perhaps took delight in the sports of the chase, and who appears to be accordin to the incription—C. Magius Heraclidæ, of the Palatine tribe, the son o Quintus; it has a handsome pediment, in which are figures of dogs hunting.

The niche which is marked 21 contains an exceedingly curious cinerary urn of baked clay; the bas relief on the front represents the hero Echetles fighting at the battle of Marathon for the Greeks, his arms are a ploughshare. Upon the cover is a female figure asleep in a recumbent position; beneath her head is a pillow. Pausanias gives the following account of the circumstances of the combatant who used so singular a weapon:—"It happened in this battle (as they say) that a man dressed and having the appearance of a peasant, and armed with an agricultural weapon, should appear when the barbarians were prevailing, who when he had slain a number of them should vanish; no one knew him as an Athenian, but others said, according to the oracle, that he was a native of Echetlæum." On the border of the urn there is an inscription over the bas relief, which is slightly cut, and has not been painted. The whole of this urn is exceedingly well designed; there is great spirit shown in the attitude of the figure who has been forced down by the strength of the rustic weapon the effort it is making to rise is true to nature; the figure with the helmet has the arms of a Roman legionary, but the shields of all the combatants are Grecian; much vigour and spirit is displayed in the *melée* of the combat.

No. 13 is a sarchophagus, on which a family is represented mourning over the body of the dead; the corpse is that of a female lying on a couch, which is surrounded by the friends and relations of the deceased: they are exceedingly well grouped, and the expressions of grief are well designed. Beneath the couch are seen the sandals of the departed, as also a wreath which has been used as an ornament to the hair: a dog, probably a favourite, is also introduced, and appears as a mourner. On each side of the sarchophagus is a griffin, resting on its hind legs; the lid and plinth are modern. It formerly stood in the Caprinaca palace at Rome, and has been several times engraved. Montfaucon mentions the sculptures of this monument, as illustrating the Roman manner of lamenting the dead; the two figures close to the couch with their arms extended are alluded to in the passage of Lucan—"*Exacte ad sævas famularum brachia planetus,*" and represent a singular part of the Roman ceremony, the "*exclamatio,*" or calling aloud, on the name of the just departed, intended either to arrest or call back the flight of the soul, or to rouse the dormant spirit in case death should not actually have taken place, that the person might not be exposed to neglect or placed upon the funeral pile while any breath of life might still remain. It might be curious to inquire if the singular custom of the death wake, still so pertinaciously adhered to by the Irish peasantry, and to perform which *dacently*, as they call it, the poorest will sacrifice all they possess, and the non-performance of which is looked upon as a sacrilege committed, derived its origin from the custom of ancient, or the priestcraft of modern, Rome. At each end of the sculpture the father and mother of the deceased are standing; an old man at the extreme end holds one hand to his eyes, in the other is a funeral cake. On each side of the female are two children. Altogether there are ten figures i the group. The father is sitting on a stool and the mother in a curule-shape chair; the head of the father is wrapped in a veil.

No. 34 is an Etruscan cinerary urn of baked clay. The bas relief in front represents the single combat of Eteccles and Polynices, who were both slain in the combat; the first from a wound in the groin, and the latter from a stab in the breast. The female figures standing by the combatants are furies; each hold a torch in one hand, while the other is extended over the antagonist encouraging and inflaming the combat; at each end, on a pilaster, is an Etruscan inscription, which is written from the right to the left in red letters. All the figures have been painted, and some of the colours yet remains. Upon the cover of the monument is a female figure asleep. The action of the whole group is excellent; the warrior who is down has lost his helmet; his hair is curled in the Etruscan fashion. His opponent is more completely armed, and the manner in which he forces the shield from his opponent, and drops his own while he stabs him to the heart, is masterly designed. The expressions on the countenance of each are different; extreme anguish in that of the fallen, and the exultation of victory in the other, are strongly defined; the figure of one of the furies is sandalled, while the other is bare. The representation of the combat as here given exactly corresponds with the account of it by the poet Statius, and it is not unlikely that he was indebted for it to these figures. It is highly probable that this contest was by no means an uncommon subject among the ancient artists. Pausanias says that the re presentation of it made one of the subjects which ornamented the sarchophag in which the tyrant Cypselas, of Corinth, was deposited: in that the sa author mentions that Polynices is represented as having fallen on his kn which is the exact attitude here represented"—"*Ex Œdipi filius Polynic* *llapsum frater Etecles urget.*" Take this sculpture as a whole, it ne of the most splendid specimens of sepulchral urn in existence.

o. 43. This is a sepulchral urn of a square form: in the centre of the nt is a tablet, on which is the following inscription :—

> "Dis manibus
> "Peliæ. Philtatæ
> "M. Pilius. eucarpus
> "Convgi. B. M.
> "fecit, et sibi."

each of the four corners is an eagle; the lid resembles a pointed roof; in e centre of the face of the urn is a bust of Pelia Philtata, and at the corners e the usual ornaments of honeysuckle flowers. The particular for which is urn is remarkable is a peculiarity in the lid, which is occasioned by a ngular custom of the ancients, and sometimes practised in honour of the eceased. When the funeral rites were performed it was the custon at stated eriods to visit the ashes of their friends, and to adorn their urns with flowers nd garlands, and to offer sacrifices of oil and wine to their manes. In some ases these visits arose from friendship or affection, but the performance of hem was often strictly ordered by the will of the deceased, and funds provided for it. In this, in order that it might with greater convenience be complied with, on the top of the lid of the urn a patera is formed, in the bowl of which is an opening through which the wine, oil, and ointments were poured upon the ashes. Propertius says—"Adfert hao unguenta mihi, sertisque sepulchrum ornabit, custos ad mea hasta sedens." Ovid in mentioning libations to the funeral urn says :—

> "Jam tamen extincto cineri sua dona ferebant,
> "Compositique nepos busta piabat avi."

On the left side of the doorway as you enter is a sepulchral urn dedicated by Flavia Dada, and by Fortunatus, a freed man of the Emperor, to the memory of her deserving husband, and his most worthy father, Admetus, a superintendent of the furniture of the Imperial Palace, and also a freed man. Above this inscription is a bas relief representing the "cœna feralis," or funeral feast. Naked to the waist is the figure of Admetus reclining on a couch; in his left hand he holds a large cup or vessel, and in his right a wreath; according to the Roman custom at feasts, his head is decorated with a garland; two children naked are sitting at his feet; behind is a female attendant, who is supporting his body; the hair of this figure is singularly bound on the front of the head in a knot. All these attendants are dwarfish in their proportions, as was frequently the case when inferior persons or slaves were represented on the ancient sculptures. These representations of the funeral feast are curious and interesting: it is impossible for us to enter into the feelings which dictated them; yet the custom of offering the funeral cake and wine at the present day may have derived its origin from it; we know not in what light the ancients regarded a future existence, but these sculptures sufficiently indicate their hopes, though they show the indistinctness of their ideas; here are the monnied dead, represented as exercising the animal functions of life; elegances are displayed to please the eye, food and wine to gratify the taste, often music to charm the ear, and garlands to perfume the air, and to these enjoyments are added the presence of their friends who are yet in existence; thus the living and the dead, the spiritual and the material world, are associated together in one common act; circumstances are represented in the history of which we can hardly participate or understand, but by which we may perceive that the ancients did entertain notions, though inaccurate and ill-defined, of a future state. The urn is ornamented at the top with garlands, which take the shape of volutes, the ends of which terminate in a rose. The præfericulum and patula are sculptured on the sides of the urn. The top has ver been separated from the body; it has a large circular excavation in the ddle, about seven inches and a half in diameter.

On the north side of the room, in the niche, the third as you enter, is an urn different from most of the others, and very rarely met with, being square, and of an upright shape; it is enriched by a festoon of laurel leaves. On it is this inscription in four lines:—"Vernasiæ Cycladi. Conivgi optima, vix. ann. xxviii. vitalis, Aug. 1. scrib. cv. B." The figures of a man and his wife are represented as standing beneath a portico, the roof or which resembles that of a sepulchral urn; they are in the act of joining hands; between them are the letters F. A. P. Lighted torches, placed in an upright position, form the corners of this urn, each side of which is embellished with a laurel tree; a wreath is placed on the centre of the lid, and a dolphin at each corner. The intention of the portico on the monument is in allusion to the entrance of the habitation of departed spirits, where the wife must take a long farewell of her partner. Among the Romans in the earlier times of the empire their neral ceremonies were always performed at night, which was formerly also he custom in this country, and the torches at the corners allude to it; and ven at a later date when the funerals took place in the day time, lighted ones always formed part of the accompaniment; those placed here are of the sort called "tædæ," being the semblance of a number of fine slips tied together with thongs. The dolphins relate to that superstition of the ancients which supposed that the spirits of the dead were conveyed by them across e seas to the happy abodes of the blessed. Vitalis, who by the inscription ected this monument to the memory of his beloved wife, Vernasia Cyclax, ms to have been a freed man of the Emperor, and a favourite, as he held ffice similar to that of private secretary; the letters "F. A. P.," between figures, denote that the tomb was erected by order of the Œdiles. No. a small slab let into the wall, it shows the manner in which the memory of the favoured dependents of a family were preserved; on it is this inscription—

ANNIOLENA	SERVILIA
T. F.	
MAXIMA	IRENE.

Within the wall which it faces are two ollæ or circular vases of earthenware, somewhat of the shape of the alabaster one near the centre on the south side of the room, in it were deposited the ashes of the two persons whose names are recorded on the slab in front. The lids of these vases alone are visible, which can be taken off, to allow libations to be poured which the pious affection of surviving friends might offer to the memory of the departed. Sometimes in family tombs four or more excavations were made in each niche, in general they are found sufficiently large at the top to allow the urn to be taken out, but occasionally, as in this, they are so constructed at the mouth that the space does not allow of the removal.

In the centre of the room is a mosaic pavement, which in the year 1805 was found on making some repairs under the south-western angle of the Bank of England, about 20 feet west of the westermost gate, opening into Lothbury; it was 11 feet beneath the surface, the design is handsome and well executed, but the workmanship is evidently inferior, and probably that of a native artist. The outer border is composed of pieces of brick. It is not sepulchral, nor is it connected with the other objects here: it evidently, from the cross in the centre, was made after the introduction of Christianity into the island.

On the south side, near the centre compartment of the room, placed on an altar, is a sepulchral urn without either inscription or decoration; it has handles and a cover, the shape is exceedingly elegant, the material of which it is made is the alabaster of the ancients, which is of a yellowish colour with pinkish stripes; near it there is another of the shape of a truncated cone, which has a cover and very small handles; the stripes on it are more strongly defined; the colour is the same, as is also the substance of which it is composed; the height of it is 20 inches, the diameter at the top 8½, and at the bottom 12.

The saloons containing the Elgin and Phigalian marbles have lately, after a variety of trials, been coloured in imitation of rose-coloured Egyptian porphyry, and the roof of grayish granite; time may in some degree reduce the luxuriancy and brilliancy of the colour; at present, perhaps, the rosy warmth which it throws over the apartments somewhat hurts the effect of the sculptures. The brown and dark appearance which time has given to these master-pieces of antiquity is compromised by the blooming walls by which they are surrounded and supported, their look of youthful pretention and roseate bloom but badly harmonizes with the severity of age. The monstrosities of Egypt in the adjoining halls would have been more in keeping with that mythias of colour by which their neighbours in a great degree are eclipsed and overwhelmed.

ON DRY ROT.

I was desirous of taking only a partial view of this subject, and of confining my observations to that species of Dry-rot which is common in new buildings; without encountering what is known by that name, which at one time threatened the extermination of the British Navy, and is by some attributed to the Fungi Sporotrichi, but I attempted in vain to make the distinction.*

The rot which I allude to, might be more properly called the damp-rot, or wet-rot, than the dry-rot, for it appears to arise from *confined moisture;* and the prevention as well as the cure for it, I believe, may consist in merely giving the confined moisture an opportunity to escape, by the admission of air. I do not mean to say that atmospheric air is a specific, by the administering of which rotton wood can be made sound; but I do mean to express my belief, that the introduction of air, even in small quantities, will effectually arrest the destructive progress of the dry-rot.

I will mention two instances now existing of this dry-rot in two new churches, namely, that of Trinity Church, Oswestry, and the New Church at Aberystwith. The former is built of rubble-stone of the neighbourhood, from Sweeney Mountain, which is a free-stone, with a large proportion of mortar; the latter is built of rubble-stone of that neighbourhood, which is of a slaty quality, with a large proportion also of mortar. In both these cases the ends of the pews are closely fitted with framed panels of deal upon damp walls, good oak floors in the former, and I think in the latter also, and risers of deal under the pew doors. The effects of this dry-rot have become very conspicuous in both instances, by an extensive destruction of the wood work, against the walls, and under the doors of the pews: upon removing the panels &c., it was found that a parasitic fungus has made extensive ramifications, and the deal is very much decayed, but the oak has as yet suffered comparatively little injury. I believe, that if a perforated plate containing apertures equal to three or four square inches had been inserted in the upper panel, fixed to the wall in each pew, and the like under each door, the mischief would not have happened; and that if these means of ventilation were resorted to now, they would stop the progress of the dry-rot. But I do not know any thing more certain to produce the dry-rot than what I have just noticed, and consequently nothing could put any expedient for the prevention or cure of the evil to a severer test than to have thus impounded the moisture. A pretty little gothic pattern, weighing three-quarters of a pound, has been prepared and partially put up in Trinity Church, for ventilating the parts affected with dry-rot.

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* The following Fungi are considered as the cause of dry-rot:—Boletus lachrymans, Merulius lachrymans, Polyporus destructor, and the genus Sprorotrichum.

The growth of the parasitic plant, and the decay of the wood coming into contact with it, seeming to be in a great degree contemporaneous, I am not prepared to say which is the cause, and which is the effect of the other; but I think that the growth of the plant takes precedence of the destruction of the wood.

I shall relate two or three facts which have come within my knowledge, because they strengthen my conviction as to the most effectual means for the prevention and cure of the dry-rot.

The usual manner of preparing the walls of a house for skirting-boards, and fixing them, is likely to produce the dry-rot, as thus:—a coat of mortar mixed with pounded glass fills up very closely the space behind the skirting-boards, to prevent mice from having a run there, and a moulded cap of wood is rabbeted and put up for receiving the plain board: on the floor is sprigged down a rib of wood, of about one inch square, for the whole side of a room, without any intermission, and the skirting-board is then scribed and closely fitted to the floor, &c.

In a new house the walls and the plaister may not be perfectly dry, and the same mischief which has been described in the pews of a church is likely to occur, and does so continually, in the decay of the skirting-boards, particularly on the ground floor; but I think that it happens less frequently when there are arched cellars below, which may carry off some of the moisture. A little of the water in washing the floor, the skirting-board being in a dry state, will find its way behind it, and increase its liability to decay, by impounding a little more moisture.

I have observed this to take place to some extent in fifteen or twenty years after a house has been built, but not perceived till the damage was considerable, because the paint will conceal it. In replacing the skirting-board instead of a continuous rib of wood sprigged on the floor, I have taken pieces of a foot or foot and half in length, leaving a vacant space of two or three inches between them, and not fitting the skirting-boards very closely to the floor, so that a small circulation of air may be preserved; and no decay has occurred in a similar period, at least I can answer for a term of thirty-five years from the erection of the building.

When a new mansion house is to be built, it often happens that a certain quantity of sound timber from an old house is to be made use of, in the shape of beams, joists, &c., and the old beams and joists are apt to be immediately applied to the ground floor, which is a great mistake. An instance of this having occurred within my knowledge, I must give a minute account of facts and consequences in order to bring them to bear on the points which are under consideration.

The front of the house faces the west, and consists of two principal rooms extending length-ways to the right and left of an entrance room, the floors being three steps above the ground; and I am pretty sure that the joists, if not the beams also, were of old timber: the boarded floors were of the best Baltic oak, prepared and finished in the most careful manner. Beneath these front rooms there are no cellars, but arched cellars extend under all the back rooms, which appear to have prevented the evil that I am about to describe as having occurred in the floors of the two principal rooms.

In the course of twenty or twenty-five years from the building of the house, the deal skirting-boards on the outward walls were found to have decayed, particularly on the west, and the floor sunk nearly an inch in some places from the skirting-boards. It was evident that the joists had failed at their insertion into the outward walls. The floor was then taken up for an opening sufficient to admit a man with a lighted candle, who crawled on his hands and knees under the floor, to ascertain the extent of the mischief: the parasitic plant or the dry-rot had got so great a footing, that it became a question whether the whole of the two floors ought not to have been taken up; but it was at length resolved to try the effect of a less expensive operation, which at the present time, after a lapse of ten or fifteen years, seems to have answered perfectly well. Several new oak joists were placed crossways beneath those which had partially failed, and as nearly as conveniently might be to the decayed ends of those joists which had wholly or in part lost their holds upon the outward walls, propping the new joists with bricks, slates, and stones; and the skirting-boards were then replaced in the manner before described.

But the thing on which the greatest reliance is to be placed was the preparation to be made for the circulation of air beneath the floors: plates of iron were cast three inches square, perforated with many holes of a quarter of an inch diameter, four of these plates were applied to each of the two rooms, two distantly from each other, at the two outward sides of the walls, below the floors, and two on either side of the fire-places in the floors, whereby a continual circulation of air was established, and has ever since been kept up: and I conceive that the progress of the dry-rot is stopt, while the supply of air required for the fires is materially assisted.

The disagreeable mouldy smell of dampness accompanying the dry-rot was evident enough as soon as the floor was opened, and continued to be less and less perceptible for months, or perhaps years, through the small grates; but those near the fire-places were covered occasionally: the grates had better have been made of brass one-third or one-fourth of an inch thick. I shall bring forward only one more instance, to prove that confined moisture is the cause of the dry-rot, and I must again be very minute, that I may be the better able to support my suggestions when I attempt to apply them to general purposes.

About the year 1820, or a little later, there was occasion to build a new sitting-room at a farm-house, and the site fixed upon was over a cellar, then roofed as a shed or lean-to: the new floor was approached by four steps out of the kitchen, the walls were built of rubble-stone eighteen inches thick, the size of the room is 14 ft. 9 in. by 11 ft. 6 in.—the floor over a slope, and from four to two feet above the ground, while a grate of seven inches square ventilates the cellar from the north.

The object of this is to show in how short a time the new floor was totally destroyed by the dry-rot, without in any way accounting for it, but from the floor itself. The joists were cut out of sound poplar, probably the upper or inferior parts of trees, and between the joists were nailed ribs of wood [illegible]port short pieces of boards for grouting in the usual manner of counter-c[illegible]ing, the floor was neatly laid with inch poplar boards well seasoned, plan[illegible] and of the best quality.

In the course of a few months, I believe, the floor joists, boards, &c. w[illegible] entirely decayed, excepting a few feet near to the door out of the kitch[illegible] which were only partially so. Although, I believe, that the decay was ve[illegible] rapid, I can only assert from recollection of some other particular occu[illegible]rences, that in the course of three years the room was built, the one flo[illegible] laid, that floor decayed, and a new floor put up, which is perfectly sound [illegible] the present time, after a lapse of more than 17 years.

The present floor is made of oak beams and joists, and very good popl[illegible] boards, without any ceiling or laths and plaister under them.

The way I would account for this extraordinary instance of dry-rot is, tha[illegible] the walls were damp when the first-mentioned floor was laid, and that th[illegible] counter-ceiling was very damp, that the boards were dry and closely fitted, that a fire was rarely (if ever) used in this room, and that the progress of the dry-rot was extremely swift, as it would be in any case under similar circumstances of confined moisture.

I may mention chamber floors of poplar boards at the present time, over a considerable extent of kitchen and other offices, which have been laid down for thirty-five years, and are as sound now as they ever were: although I have seen poplar boards used as window shelves in inferior apartments, and in some other ways, which have gone into complete decay, grub-eaten or otherwise, in the course of a few years.

The reader who may have waded through the details of facts, which I have thought necessary for my purpose, may wish to have the conclusions drawn from them recapitulated in a few short sentences, as thus:—That wherever joiner's work is to be fitted to newly-built walls, there should be means taken for the circulation of a little air. That the beams and joists used for the ground floor of a house should be of British oak, larch, or best foreign deal. That the ends of beams or joists inserted into the outward walls of a new house, on the ground floor, should be cased with sheet lead, zinc, or cast iron, all impervious to moisture, but not too tightly fitted, for fear of the sap's producing confined moisture; or they might be secured at their ends with cases made on purpose of fire-brick clay, or other clay impervious to moisture. I have used cast-iron sockets and fire-brick cases very satisfactorily. That the wooden ribs upon which the lower edges of the skirting boards are to be nailed should not be in continued lengths, without some intermission. That wherever floors are laid with stone bricks, or slate flags, the skirtings should be made of slate-flags from three-quarters of an inch to one inch in thickness, with one sawed edge. That in servants' halls and other offices, where it may be desirable for the skirting or dado to extend to the height of three feet or more, slate-flags of three-quarters of an inch or one inch thick, might very properly be preferred to wood, but capped with a grooved ledge of wood; these slate-flags being worth only about 9*d.* the square yard.

Many of the particulars respecting the rooms which have been affected with dry-rot may, as I have observed before, appear trivial, or even ludicrous; but when it is recollected that we have been alluding to facts that occurred fifteen or twenty years ago, and which engaged attention only for the moment, I wish to state what is still to be seen; and more particularly to show, that there was nothing in the position nor dimensions of the room last-mentioned; neither door, window, chimney, nor any other circumstance, whereby such an effect of dry-rot could have been produced or promoted, excepting only by the *confined moisture*, and to which alone the dry-rot is to be attributed.

A simple remedy for any grievance is sometimes unpopular, and you may be advised to poison unwelcome vegetation as you would rats, without considering that poison, like gun-powder or steam, is not a thing to be played with.* Is it not more reasonable to trace a mischief, if possible, to its cause, and by removing or counteracting the cause, endeavour to prevent or arrest the progress of the effect? Suppose that a ship may be liable to dry-rot, from confined moisture and the sap (juice) of unseasoned timber,† the natural remedy would be to give a change and circulation to the stagnant atmosphere by ventilation: I see no reason why dry-rot in a ship might not be prevented or arrested by a sufficient number of small grates, which have been used so successfully about the floors of the two rooms as above described.—*Salopian Journal.*

ON THE ECONOMY OF RAISING WATER FROM COAL MINES ON THE CORNISH PRINCIPLE.

At the annual meeting of the members of the Manchester Geological Society, held at their rooms, on Thursday, the 29th October, Mr. Fairbairn read a communication "On the Economy of raising Water from Coal Mines on the Cornish Principle." In introducing his paper to the meeting, Mr. Fairbairn, after explaining the sections of the engine and pumps made by him for some Belgian coal mines, said, that the improvements introduced of late years into the Cornish engines, were of so important a nature as to be highly worthy the attention of the miners of this district. They had not, till very lately, the slightest conception of the great saving effected by the performance of rnish engines, which was so great that the pressure of steam in the inder, which would amount to 7,500 lb. per square inch, would raise nearly uble the amount of any in the neighbourhood, chiefly from the advantages the expansive principle adopted in the Cornish engine. Mr. Fairbairn then oceeded with his paper, of which the following is an abstract:—

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* Corrosive sublimate is the only known specific, mineral or vegetable, for preventing the growth of the dry-rot fungi, and which, I believe, has formed the basis of Mr. Kyan's patent.

† Oak would require less seasoning, and be much fitter for use, if it w[illegible] cut down in winter instead of in spring. I recollect, some fifteen or tw[illegible] years ago, observing a sound oak plank in the gable end of a house wh[illegible] was under repair; some of the sap (alburnum) and bark was still on the [illegible] and very slightly grub-eaten, although it might have been in the buil[illegible] an hundred years, perhaps, or more, on the inside of an outward wall, n[illegible] with bricks, and never had been covered with plaister nor colour of an[illegible]

"The steam engine performs so important a part in almost all the transac- ns of man, where great power is required, that the progressive improve- ents of this mighty agent, indispensable to the miner, must be regarded ith interest by all. By the geologist its improvement will be looked at with dditional pleasure, since by its means he is enabled to explore the earth to a uch greater depth than he otherwise could have done. For this reason, I ave thought it might not be out of place to give here some account of the rogress of the steam engine during the last 120 years, mentioning the dates f its leading improvements.

"From the time of Savery and Newcomen, in 1707, to that of Beighton, in 1717, it remained stationary, till 1769, when Smeaton introduced considerable improvements upon atmospheric engines, the average duty from fifteen of which amounted to 5,590,000 lbs., lifted one foot high by a bushel of coal.* These improvements continued; and the duty, in 1772, was raised to 9,450,000 lbs.

"Mr. Watt's improvements commenced in 1776, when the average duty was declared at 21,600,000—more than double that of Smeaton's; and, during the years 1778-9, it was still further increased.

"In 1779, and from that to 1788, Mr. Watt introduced the improvement of working steam expansively, which raised the duty to 26,600,000. From 1788 to 1812, few, if any improvements were made in the Cornish engines; and, provided we except the plunger pole, which was introduced about this time, I question whether the Cornish engineers and miners did not retrograde rather than advance during a period of twenty-four years.

"In 1814 considerable advances were made, which raised the duty to 32,000,000 lbs. During that year, Woolf's engine, with two cylinders, was introduced, which again advanced the duty to 54,000,000 lbs.

"Mr. Woolf, above all others, did most for the Cornish engines, by showing the advantages peculiar to high pressure steam, and prepared for subsequent improvements, which led to the present effective system of expansive working.

"During a period of six years, from 1814 to 1820, Woolf's double cylinder engine maintained its superiority, and gave a higher duty than any other.

"Woolf's engine, in process of time, gave way to others of a better construction. They were introduced by Captain Samuel Grose, whose experiments upon the generation and preservation of heat led to great improvements, and ultimately established a new era in the history of the Cornish engine.

"In 1826, Captain Grose's engine, at Wheal Hope, attained a duty of 62,000,000 lbs.; and, in July of the following year, one of Mr. Woolf's single cylinder engines performed the unprecedented duty of 67 million.

"From this time Captain Grose's improvements were appreciated, and generally introduced; they led to a still greater advance in the duty, which this year reached as high as 87 million lbs.

"Messrs. Lean and Brothers report the duty of a few of the Cornish engines at this time as follow:—

	Millions lbs.
Wheal Towan Engine	87·0
Wheal Hope	74·8
Consols	67·6
Binner Downs	63·5
Consols	61·7
Consols	61·3
Wheal Vor	61·1
Wheal Towan, (Druce's)	59·4
Consols	58·4
Poldice	57·8
Wheal Vor	51·9

These give a mean duty of sixty-four millions of pounds.

"Nothing remarkable took place till 1834, when the duty was raised to 90 millions lbs. Since then, it has continued to increase in the ratio of 90, 00, and 110 millions: and during the last meeting of the British Association, at Glasgow, Mr. Taylor reported the present duty at the unequalled performance of 123, 300,593.

"Having briefly stated the progressive improvements that have taken place in the Cornish system of pumping, I would now direct the attention of the society to the important results which these improvements have produced.

"The quantity of coals consumed by all the engines working at the mines in Cornwall, in the year 1835, was, according to Messrs. Lean and Brothers, 1,669,421 bushels. Now, if we compare this with the number of bushels which would have been consumed to produce the same power in 1814, we should have, for the consumption at that period, 4,049,878 bushels, making a saving of 99,186 tons; which taken at 17*s.* per ton, (the price of coal in Cornwall,) we have the enormous saving of £84,308.

"From the above facts, it cannot be doubted, that the improvements in steam engines, and the consequent saving thus effected in the consumption of fuel, are matters of deep importance. Even in districts where coal is cheap, it is a consideration well worthy of attention; and we are assured by geologists, that the coal of this country, although abundant, will not last for ever."

In the course of a very interesting discussion which followed the reading of the paper, Mr. Fairbairn said, he might mention that so great was the saving from the improved system of working the Cornish engines, that it was not improbable that, in this neighbourhood, we might come back to the old system of power for factories. If the duty performed by the Cornish engine was so much more than that of any factory engine in this district, it might be desirable to have a Cornish engine connected with a water-wheel to drive mill machinery.*

Mr. Boothman.—Why not apply it to rotatory motion?—Mr. Fairbairn said, that it would not apply to any thing where the force required was constant. The value of the thing lay in overcoming the inertia of matter. The Cornish engine first raised a weight, and then, by the descent of that weight, it raised the water. That was the whole secret of the Cornish engines.

Mr. P. Clare asked if Mr. Fairbairn had made a calculation of the effective force of the factory engines in this neighbourhood, so as to afford a comparison as to the combustion of coal by them with that of the Cornish engines?—Mr. Fairbairn said, he had done so. The consumption of fuel in our best condensing engines here was 10 lbs. to 12 lbs. per horse power per hour, while the consumption of fuel by the best Cornish engines was only 2¼ lbs. per horse power per hour. In other words, we consume four times more coal than the Cornish engines in producing the same effect. The circumstance was most extraordinary; but the facts were before the meeting. The returns of the duty performed were regularly registered in Cornwall, and published monthly, so that any gentleman might see them, in reference to any period; and it would be found, that the performance of the best Cornish engines (for he did not, in reference to this question, speak of the average duty) did not exceed a consumption of 2½ lbs. of coal per horse power per hour.

A Member asked whether there was not some doubt as to the accuracy of the calculations of the duty performed by the Cornish engines, and as to the mode of estimating them?—Mr. Fairbairn said, that the calculations were made upon the area of the bucket and the length of the stroke. He was aware that doubts had been expressed as to the accuracy of the calculations; but they were backed by such authorities, and the returns were so numerous and regular, that he thought their general accuracy could not well be doubted.—The Member observed, that a small quantity of air coming up the pumps would make a difference.—Mr. Fairbairn: No doubt; but still the engine has to lift this great weight of all the pumps and iron work, and the plungers, which must be lifted by the force of steam. He had a return from Mr. Wicksteed, of the East London Water Works, which was not a pit at all; but the Cornish engine there was used to raise water for the supply of the eastern part of London—which return gave a duty of 118,552,475 lbs. raised one foot high; the consumption of fuel being 2·4 lbs. of coal per horse power per hour. Of course he did not speak of the duty performed by these Cornish engines from his own knowledge, but he had every reason to believe the returns substantially correct.—The Member said, he believed, some doubts had been repeatedly thrown on the method of calculation.—Mr. Fairbairn said, that some years ago he had been present at a discussion on the subject in the Society of Civil Engineers, when great doubts were expressed, but further documents were brought forward to prove the accuracy of the calculations. However, taking the consumption of fuel by the Cornish engines to be 3 lbs. per horse power per hour, that was a very great difference, as compared with our factory engines.

Mr. Eaton Hodgkinson thought there had undoubtedly been great improvements made in the Cornish engines, chiefly the result of the adoption of the expansion of steam, which they had not been used to any great extent in this neighbourhood, at least till very recently. Whether the returns were quite accurate or not, no one could doubt that the improvements were immense. He thought the plan of making the engine to lift the pump-rods only, and then the descent of the pump-rods lifting up the water, seemed to be a considerable improvement in adaptation. Again, whether Mr. Woolf's plan of the expansion of steam, or that of Mr. Watt, expanding it in the same cylinder, and cutting it off when at a distance of one-fourth or one-fifth down, were adopted, (and it was a question as to which plan was the best,) in both cases there was a great improvement upon former methods. These improvements had a strong bearing upon geology, for were it not for these engines, they could not investigate the strata in mines, for the water would drive them out or drown them. These engines, by draining lakes, might enable the geologist to obtain a great deal of information he must otherwise be without.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Tenth Meeting.—*September*, 1840.

(From the Athenæum.)

Section G.—Mechanical Science.

Mr. James Milne gave an account of an instrument termed *a Gas Regulator*, of his invention, by means of which the length of the flame is equalized, notwithstanding the variations of pressure that occur, and a considerable saving in the consumption of gas is effected.

Mr. Coles *on Railway Carriages.*—Mr. Coles proposes to introduce friction wheels; and that, excepting the first and last carriage in the train, the carriages should run on *two* wheels. He also proposes a step-rail at the curves or bends.

"*On the Turbine Water-wheel.*" By Prof. Gordon.

The fundamental principle upon which the construction of the *Turbine-Fourneyron* is based, is that by which the maximum of useful effect is obtained from a given fall of water, depending on the relative velocity of the water and its recipient, which ought to be such that the water enters the wheel

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Duty is a term first used by Mr. Watt for ascertaining the comparative ts of steam engines. In Cornwall it is used for determining the number lions of pounds of water lifted one foot high by a bushel of coal, (94 the time of lifting it not being considered.

* See Mr. Wicksteed's report in the Journal for January last, page 7.—Ed. C. E. and A. Journal.

without shock, and quits it again without velocity. A notion of its construction may readily be formed, by supposing an ordinary water-wheel laid on its side, the water being made to enter from the interior of the wheel by the inner circumference of the crown, flowing along the buckets, and escaping at the outer circumference. Then centrifugal force becomes a substitute for the of gravity. A drawing was here exhibited of a Turbine of about 5 horse force power, the fall being 3 feet, and the expenditure of water 20 cubic feet per second. It was explained that the Turbine consists essentially of—1. A reservoir, the bottom of which is divided into radial compartments by curved plates, serving to guide the water to take a particular direction of efflux. 2. A circular sluice, capable of nicety of adjustment. 3. The wheel with curved buckets, on to which, when the sluice was raised, the water entered at every point of the inner circumference, and flowing along the buckets, escaped at every point of the outer circumference. This latter is a characteristic feature in the Turbines of Fourneyron. Reference was made to the principal Turbines erected in France and Germany,—particularly to that at Inval, near Gisors, and those at Müllbach and Moussay, as illustrative of their use for falls varying from 9 inches to 10 feet. And, again, to those at St. Blasier, in the Black Forest, as instances of high falls,—the one being 70½ feet, the other 345 feet; the one expending 5 cubic feet per second, the other 1 cubic foot per second; the one being 56 horse power, the other very nearly 60 horse power; the one giving an efficiency of upwards of 70, the other of upwards of 80 per cent. of the theoretical effect. A drawing of the latter was exhibited—full size. It is 14½ inches diameter. Its extreme depth or *breast* is ·225 inch, or less than ¼. It makes 2,200 to 2,300 revolutions per minute. It serves a factory, in which are 8,000 water spindles, 34 fine and 36 coarse carding-engines, 2 cleansers, and other accessories. The conclusions drawn by Morier from his experiments on these wheels with the Break dynamometer, or friction strap, are these:—1. That Turbines are with equal advantage applicable for high and for low falls. 2. That their net useful effect equals 70 to 78 per cent. of the theoretical effect of the power. 3. That they may work at speeds varying from

$$n=\frac{3{\cdot}3\,V}{R} \text{ to } n=\frac{5{\cdot}6\,V}{R}$$

Where n = number of revolutions; V = velocity due to fall; R = extreme radius. The useful effect still not differing notably from the maximum. 4. That they work at very considerable depths under water, the relation of useful to theoretical effect not being thereby much diminished.

Mr. Smith (Deanstown) said, there was much in the principle for very high and very low falls, and for varying falls. The principle had been long applied in Perthshire, but in that part of the country a great velocity is obtained at a great expenditure of power.—Prof. Gordon stated, that for all falls above 50 and below 10 feet, the Turbine is to be preferred.—Mr. Fairbairn: The common water-wheel at Gisors, in France, was made by himself and comparative trials were made with it against the Turbine. Mr. Fairbairn was quite satisfied, by Arago's experiments, and otherwise, that the Turbine is a very important machine, and gives a result of 70 to 75 per cent. of the theoretical effect.—Mr. Smith proposed, that as he had peculiar facilities for experimenting on the subject, he, along with Prof. Gordon and Mr. Fairbairn, should investigate the comparative merits of the Turbine and other water-wheels before the next meeting of the Association.

"*On producing True Planes or Surfaces on Metals.*" By Mr. Jos. Whitworth.

Surface plates were exhibited, intended to illustrate the proper mode of preparing surfaces where great accuracy is required. If one be put upon the other, it will float, until by its weight it has excluded some of the air, when they will adhere together with considerable force. These surfaces were got up without grinding. The only operations performed upon them were those of planing, filing, and scraping. Practically, the excellence of a surface consists in the number and equal distribution of the bearing points; the more numerous these are, and the nearer together, the more perfect is their action. But, if a ground surface be carefully examined, the bearing points will be generally found lying together in irregular masses, with extensive cavities intervening. The cause of this irregularity is evident in the unmanageable nature of the process. The action of the grinding powder is under no control. There are no means for securing its equal diffusion, or for modifying its application with reference to the particular condition of different parts of the surface; while the practical result is, that the mechanic neglects the proper use of the file, knowing that grinding will follow, to efface all evidence either of care or neglect. In various departments of the arts and manufactures, the want of improvement in this respect is already felt. The valves of steam engines, for example, the tables of printing presses, stereotype plates, slides of all kinds, require a degree of truth much superior to that they now possess, for want of which there is great waste constantly accruing in time, in steam power, in wear and tear, and, above all, in skill misapplied. The improvements so much to be desired will follow upon the discontinuence of grinding, The surface plate and the scraping tool will then come into vogue, and a new field will be opened to the skill of the mechanic. Supposing him to be provided with a true surface plate, he will find no difficulty, after a little practice, in bringing up his work to the required nicety. For this purpose he will find it advantageous to employ a scraping tool made from a three-sided file, and carefully sharpened on a Turkey stone, the use of which must be frequently repeated. A light colouring matter, such as red chalk and oil, being spread over the surface plate, and the work in hand applied thereto, friction will cause the prominent places to be marked, which will instruct the expe mechanic where and how to operate to the greatest advantage.

Mr. Scott Russell presented the Report of the Committee *On the Form Vessels:* the members of this Committee were Sir John Robison, Mr. Sm (Jordan Hill), and himself.

Since their appointment by the Association, the Committee had been co stantly engaged in carrying out the various investigations committed to th charge; and it had been their earnest desire to discharge their duties in su a manner as conclusively to settle the many important practical questions naval architecture which were matters of uncertainty and dispute, especial in refereuce to steam navigation. The importance of precise knowledge constructing a mercantile navy, ships of war, and steam vessels, was reckone so great, that in almost all civilized kingdoms experiments had been under taken at the national expense, and Italy, Spain, Sweden, and France had ob tained by those means a very superior knowledge of the principles of the construction of ships. In this country the labours of individuals had supplied the only experiments of this nature; and it was matter of regret, that these were not of such a description as to furnish the ship-builder with any certain foundation for rules of art. The new demand upon the invention of the naval architect by the introduction of steam power, had also contributed much to augment the disparity which already subsisted between the data of experimental hydrodynamics and the demands of the practical builder of ships. It had also been thought not improbable, that certain singular phenomena in hydrodynamics, recently discovered, might considerably modify the views hitherto entertained of the nature of fluid resistance; and the Association had, therefore, resolved on the appointment of this Committee, for the purpose of giving this subject a thorough and searching examination. The first subject of concern with the Committee, was the mechanism by which to conduct experiments on a scale sufficiently large to render the results of practical value, and at the same time sufficiently manageable to free the experiments, as far as possible, from elements foreign to the immediate subject of examination. It was desirable to obtain, for experiment, a force capable of moving the vessels subjected to experiment, through the water with an uniform force and velocity capable of being continued for a considerable interval of time over a considerable length of space. All the forms of apparatus hitherto adopted for the purpose of experiment, were examined with the view of adopting the best. None of them appeared fully to answer the end in view, and it became necessary to invent another and better apparatus for giving motion to the vessels. This had been found: a simple contrivance of Mr. Russell's had been adopted, by which a force, perfectly uniform, could be applied without inconvenience throughout any given space, free from the usual errors of friction, rigidity, &c., which had become interwoven with the results of former experiments. This apparatus he regarded as an engine of experiment so important to the future acquisition of knowledge of the resistance of fluids, that he was desirous to communicate it to the distinguished men around him taking an interest in the subject, in order that if it met their approbation, they might avail themselves of it in future investigation. He then proceeded to give a description, with illustrative drawings, of an apparatus by which experiments were made of from a small scale up to 100 feet in length, over a sheet of water from 100 feet to half a mile or a mile in length. For each scale of experiment, strings, cords, and ropes of various thickness were employed; and for the most delicate experiments, a slender Indian fibre, brought home by Sir John Robison, had been found most useful. Two chronometers by Robert, of Paris, also brought over by Sir John Robison, were employed with great advantage, as observations were obtained which could be depended on within two-tenth parts of a second. The next point to be determined was, the general method of conducting the experimental inquiry, so as to elicit the most valuable truths, and those most apposite practical art. For this purpose the most eminent ship-builders were consul ed, as to the points upon which they most wanted information, and were requested to point out what were the forms of vessel which they would wish have tried. More than 100 models of vessels of various sizes, from 30 inches to 25 feet in length, had been constructed. These were drawn through the water with various velocities, and at different degrees of immersion, so as to determine the resistance of all the various forms that might be adopted in practice, and enable the builder to adopt the form best suited to his purpose. A large pile of papers, laid on the table, contained the results of the experiments, which were still continued. Of these experiments, different series were conducted with very various objects. One class regarded the transverse sections of ships; another the water-lines of the bow; another the water-lines of the stern; another the form of ribband-line and of buttock-line another class, the place of greatest breadth, and so on. From these experiments it resulted that vessels might be made fuller than usual at some points and finer in others, with great advantage. A peculiar class of lines, called by Mr. Russell "wave lines," appeared best adapted for high velocities both in smooth water and at sea. It also appeared, that the manner in which the particles were displaced by a moving body, and replaced themselves after its passage, was very different from what was generally supposed. There also appeared to be three different conditions of fluid motion and resistance companied with distinct characteristic phenomena: motion slower than th of the wave—motion on the wave—motion on wings of water. The last curred only at very high velocities, and when two high and beautiful fil water spread themselves in the air, and carried the boat as on gossam along the surface of the water. Mr. Russell concluded the report that the experiments would soon be published, and submitted

The remo clearing gaseous fluids to ascend is "*inversely* as the square roots of their gravities," the velocity of its escape by the chimney, compared with mmon air of the same temperature, is about as 1·4 to 1; therefore the mpound mixture of steam, air, and carbonic acid gas, will escape with a nsiderably increased velocity, and more air must consequently enter the nace. It appears that about 10 per cent. of the total quantity of steam nerated is necessary to effect the combustion of the smoke by this means; erefore, unless the waste steam only be used, the saving of the fuel must e reduced by this amount. Brief mention is made of the experiments of lessrs. Apsley Pellatt, Parkes, and the Chevalier de Pambour, proving that given quantity of oven coke will produce as much heat as the coal from hich it was produced; and of the various kinds of artificial fuels which had een invented, especially that composed of resin and peat coke, of which the author remarks that its combustion probably produces a mechanical effect, as the hydrogen is converted into water in a state of vapour, which escapes through the chimney with a great velocity, and consequently a large quantity of air is drawn into the furnace, and a more perfect combustion of the fuel is the result. In the same manner he accounts for the necessity which exists for having the openings between the bars wider in a furnace in which coke is burned than in one used for coal. In opposition to the general opinion, he considers that less air is required for the consumption of coke than for coal; the carbon only requiring 2½ times its weight of oxygen for its combustion, while the hydrogen contained in coal requires 8 times its weight of oxygen; and the only reason that the openings between the bars are required to be wider in the former than in the latter case, is in consequence of the draught being so much slower during the combustion of coke

3dly. "On the nature and application of the volatile products of coal." In treating this portion of the subject—many of the observations on which have been necessarily anticipated in the preceding sections—the author traces the application of carburetted hydrogen gas to the purposes of artificial illumination from the year 1798, when its first successful application was made by Murdock at Soho; he then proceeds to Dr. Henry's investigations of the phenomena of its production and combustion; the variation of the intensity of light obtained from carburetted hydrogen, due to the proportion of carbon contained in it; the difference in the gas obtained from different qualities of coal; the superiority of the illuminating power of the gas from Cannel coal; and the still greater power of that produced from the decomposition of oil, which is 2 to 2½ times greater than that of coal gas. He then mentions the other products of coal by distillation, such as ammoniacal liquor, carbonic acid and oxide, sulphuretted hydrogen, tar, essential oil, naphtha, petroleum, asphaltum, and other substances. The paper concludes by pointing out the advantages which would result from the production of such gas as is usually given out at the beginning of the distillation of coal, as it contains 2 volumes of gaseous carbon united with 2 volumes of hydrogen, and its illuminating power is consequently more than double that of ordinary coal gas.

Mr. Parkes observed, that the quantities of air required for the combustion of different fuels as determined in the laboratory and on the large scale of practice, were frequently very different. It might be quite correct that a given weight of coal would require more air for its perfect combustion than the same weight of coke. There was great difficulty in ascertaining the fact practically, under steam-boilers, as the gases given out by the coal must have air supplied to them distinct from that which passed through the grate to ensure their perfect ignition, and many circumstances prevented the consumption of air from being exactly measured. Generally, he had found it necessary to use wider spaces between the grate bars for coke than for coal. In some late experiments very carefully made on a boiler invented by Mr. A. M. Perkins, equal weights of coal and coke required the same time for their destruction on the same grate, the apertures of the damper and ash-pit door, which were used to govern the draught being precisely the same. Coke effected a greater evaporation than coal at similarly rapid and slow rates of combustion; and in every case the temperature of an oil bath at the foot of the chimney was higher with coke than with coal. It must, however, be remarked, that no process had been used to ignite the gases which escaped from the furnace uninflamed. He had tried different kinds of coke, coal, and anthracite at this boiler, and the same fuel in every instance performed a greater evaporative effect at a slow than at a rapid rate of combustion. He thought that much of the air which entered the grate of a boiler passed through the fire unconsumed, for want of time to effect a sufficiently intimate combination with the fuel. In some experiments lately made at Swansea on the properties of anthracite, Dr. Schafœutl had found from analysis, that no less than 40 per cent. of the products of combustion taken from the chimney consisted of oxygen, yet he had effected the large evaporation of 11 lb. of water with 1 lb. of that fuel.

Mr. Field stated, that Mr. Cooper had expressed an opinion that in the use of coke as a fuel, a less portion of heat reached the chimney than with coal, on account of the large quantity of unconsumed air that passed through the fire, owing to the open spaces necessarily existing between the pieces of such a dry fuel as coke; whereas in a fire made of binding coal, nearly the whole of the air combined with the fuel in its passage through the body of fire.

Mr. Pellatt observed, that although in practice coke appeared to require re air to support combustion than coal did, yet long experience had taught [illegible] believe that when coal was exposed to a rapid combustion, it required [illegible] than coke.

[illegible] o an observation that some experiments lately made on the measurement of the quantity of air which entered the blast furnaces of Sir John Guest at the Dowlais Iron Works might bear on this subject—Mr. Farey objected to the application of such results to determine the question, as the air is injected with considerable force into a furnace; there is frequently a great reflux of blast from the Tuyere when the furnace is working close; whereas when it is working open the flame at the top shows that the passage of the air through the mass of burning fuel is very free, and that consequently a portion of it passes off unconsumed. He had found in his experiments on blast furnaces, that unless there was a redundancy of carbon, and a deficiency of oxygen, there was no chance of making good iron.

May 26th.—The PRESIDENT in the Chair.

The following were balloted for and elected:—Thomas Illman, Joseph Chessborough Dyer, and G. S. Saunderson, as Associates.

"*On a new Mode of Covering Roofs with Planking.*" By William Cubitt, Assoc. Inst. C. E.

The roof itself is framed in the usual manner with principals and purlins, but without rafters. The boards intended for the covering are cut, by means of a circular saw, from planks 7 inches wide by 2¼ inches thick, in such manner that each plank makes two boards, the one tapering from its centre towards the edges, the other from its edges towards the centre. The hollow boards are laid side by side, at intervals of 4½ inches, and nailed to the purlins by their centres only, so as to admit of shrinking; the intervening spaces are then covered by the other boards, overlapping 1¼ inch on each edge, and nailed in like manner. The covering thus formed presents a series of alternate elevations and depressions, longitudinally from the ridge to the gutter, and consequently the rain falls off very rapidly, and a roof so constructed is easily kept water-tight. The author conceives this to be the most economical mode of using timber for covering, and he has adopted it extensively. The communication was accompanied by a model of the roof and specimens of the boards as they are left by the saw.

"*On Long and Short Connecting-rods for Marine Engines.*"

A letter was read from Ardaseer Cursetjee, of Bombay, inviting a discussion on the relative advantages of long and short connecting rods for marine engines. He was induced to make inquiry on this subject from some observations in a communication to the Institution, relative to the engines of the steam tug the "Alice" (Minutes of Proceedings, page 385). In that paper their superiority is in part attributed to the increased length of the connecting rods. This is the point upon which he requests information, as he conceives that the power of the piston upon the crank is the same whatever may be the medium through which it is transmitted, and the effect to be the same throughout a complete revolution, whether the connecting rod be long or short, except that from the increased angle of a very short connecting rod some additional friction is thrown upon the joints.

On the general construction of the engine of the "Alice," he remarks, that engines of similar form are now used for pumping at the Thames Tunnel under Mr. Brunel's direction; and that a pair of engines of this kind were built by Messrs. Seaward, 13 years ago, for the "Staadt Francfort" steamboat, to ply between Francfort and Coblentz; in this instance, the cylinders were firmly fixed to the bed-plate and sleepers, with the cross bars above the cylinders, thus having one connecting rod only leading to the cranks, which he considers a superior arrangement to that of the engines of the "Alice."

A drawing of the engines of the "Staadt Francfort" accompanies the communication.

A letter was read from Mr. John Cooper, of Dover, describing the effect of the worm (*Teredo navalis*) on several kinds of timber which had been exposed to the action of sea water. The kinds of timber on which the experiments were made were fir, English oak, and African oak; specimens of each sort, some Kyanized and the others unprepared, having been tried under exactly similar circumstances on the piles of the south pier of Dover harbour. The results show that Kyanizing timber does not in any degree protect it; as, after exposure from December 1837 until May 1840, it was found that the worm made equal ravages among all the specimens. The author also tried the process of saturating timber with copperas water, but did not find any good result from it. In July 1835, he placed under water some 2-inch oak planks which had been prepared with copperas; and on examining them in May 1840, they were found to be as much attacked by the worm as the worst specimens of unprepared fir timber which had been exposed for a similar length of time. The African oak resisted the attack of the worm better than either fir or English oak.

It was stated that Teak timber resisted the attacks of the worm and of the white ant, which destroy all other kinds of timber. It is, however, liable to injury from the attacks of barnacles.

"*On the Corrosion of Cast and Wrought Iron in Water.*" By Robert Mallet, Assoc. Inst. C. E., &c.

This communication is one of those forwarded to the Institution in consequence of the Council having considered this subject a suitable one to compete for the Telford Premiums; and the author having been long engaged in making experiments on this subject at the request of the British Association, refers in the introductory part of this paper to the contents of that report, which may be viewed as a "*précis*" of the state of our knowledge on the subject to the year 1839, together with original researches forming the basis of the present results. This communication is accompanied by a most elaborate set of tables of results; but these laborious investigations being yet in progress, the author directs his special attention to so much only of the subject as may be necessary for their elucidation, divesting his remarks as much as possible of a purely chemical character, and confining them to those practical conclusions which are of immediate use and importance of the engineer.

The tables of results are altogether twelve in number. The first five contain the data and results of the chemical or corroding action of sea and fresh water on cast and wrought iron under five several conditions, during a period of a year and ten months; and these five series of experiments are so coordinate with each other as to form one connected and comparable whole, whence the relative rates and absolute amounts of corrosion of cast and wrought iron—by, 1. clear sea water, 2. foul sea water, 3. clear sea water at temperature 115° F., 4. foul river water, and 5. clear river water—may be ascertained. The corrosive action of water and air combined produces on the surface of cast or wrought iron a state of rust possessing one of the five following characteristics—1. Uniform, 2. uniform with plumbago, 3. local pitted, 4. local pitted, 5. tubular—or of two or more of these characteristic conditions in combination; these facts for 82 different specimens of British and Irish cast iron--together with their original external characters, mode in which they were cast, specific gravity, dimension and weight before and after immersion, loss of weight per square inch of surface, this loss referred to a standard bar, and the weight of water absorbed for clear sea water—compose Table I. The four subsequent tables contain similar results for specimens of iron immersed under the other four conditions mentioned above. These five tables contain also the results of the corrosion of certain cast iron protected by either of ten several paints or varnishes, the results of which are comparable with those for the unprotected iron. Table VI. exhibits the general comparison of the results set forth in the preceding tables for specimens of iron one inch thick, and reduced to one common or equal period of immersion. Table VII. shows the *average loss* of all varieties of cast iron experimented on per square inch of surface. Table VIII. the average calculated amount of corrosion (assumed uniform) of various specimens of cast and wrought iron per superficial foot of surface at the end of one century. From these tables it appears, that the metallic destruction or corrosion of the iron is a maximum in clear sea water of the temperature of 115° F.—that it is nearly as great in foul sea water—and a minimum in clear fresh river water.

Iron under certain circumstances is subject to a peculiar increase of corrosive action—as, for instance, cast iron piling at the mouth of tidal rivers—from the following cause. The salt water being of greater density than the fresh, forms at certain times of tide an under current, while the upper or surface water is fresh; these two strata of different constitutions coming in contact with the metal, a voltaic pile of one solid and two fluid elements is formed; one portion of the metal will be in a positive state of electrical action with respect to the other, and the corrosive action on the former portion is augmented. The lower end of an iron pile, for instance, under the circumstances just mentioned, will be positive with respect to the other, and the corrosion of the lower part will be augmented by the negative state of the upper portion, while the upper will be *itself* preserved in the same proportion. From this theoretical view may be deduced the important practical conclusion, that the lower parts of all castings subject to this increased action should have increased scantling.

The increased corrosive action of *foul sea* water may be referred to the quantity of hydrosulphuric acid disengaged from putrifying animal matter in the mud, converting the hydrated oxides and carbonate of iron into various sulphurets, which again are rapidly oxidized further under certain conditions, and becoming *sulphates* are washed away. Hence the rapid decay of iron in the sewage of large cities, and of the bolts of marine engines exposed to the bilge water. The corrosive action being least in fresh water may be partly referred to this being a worse voltaic conducting fluid than salt water.

It appears also that wrought iron suffers the greatest loss by corrosion in hot sea water; which fact has led the author to inquiries, with reference to marine boilers, at what point of concentration of the salt water, whether when most dilute, after the common salt has begun to deposit, or at a farther stage of concentration, the corrosive action on wrought iron is the greatest, and he points out the important practical use which can be made of this information. It appears also, that the removal of the exterior *skin* of a casting greatly increases the corrosive action of salt water and its combined air, so that the index of corrosion under these circumstances is not much less than that of wrought iron, and in clear river water is greater.

It farther appears, that chilled cast iron corrodes faster than the same sort of cast iron cast in green sand, and that the size, scantling, and perhaps form of a casting, are elements in the rate of its corrosion in water. The explanation of these facts is to be found in the want of homogenity of substance, and the consequent formation of numerous voltaic couples, by whose action the corrosion is promoted. It is also observable that the corroded surface of all these chilled specimens is tubular.

It appears also that, in castings of equal weight, those of massive scantling have proportionately greater durability than those of attenuated ribs and feathers. Hence appears also the great advantage of having all castings, particularly those intended to be submerged, *cooled in the sand*, so as to insure the greatest possible uniformity of texture. The principles now stated afford an explanation of the fact often observed, that the back ribs of cast iron sheet piling decay much faster than the faces of the piles. It is also probable that castings in dry sand and loam will, for these reasons, be more durable than those cast in green sand. The general result of all these experiments gives [illegible] satisfaction a preference to the Welsh cast iron for aquatic purposes, and t[illegible] Manchest[illegible] possess closeness of grain. Generally, the more homogeneous, the [illegible] Trea[illegible] and closer grained, and the less graphytic, the smaller is the index of corrosion for any given specimen or make of cast iron.

The author next proceeds to the important question of the protection afforded by paints and varnishes. White lead perishes at once in foul water, both fresh and salt; and caoutchouc dissolved in petroleum appears the most durable in hot water, and asphaltum varnish or boiled coal tar laid on while the iron is hot under all circumstances. The zinc paint, which is now so much noticed as an article of commerce, the author has analyzed, and states its composition as—

Sulphuret lead	9·05
Oxide zinc	4·15
Metallic zinc	81·71
Sesqui-oxide iron	0·14
Silica	1·81
Carbon	1·20
Loss	1·94
	100·

It may, *a priori*, be considered likely to produce a most excellent body for a sound and durable paint under water. The black oxide of manganese has no advantages but that of being a powerful drier. The defects of all oil paints arise from the instability of their bases; the acids which enter into the constitution of all fixed oils readily quit their weakly positive organic bases to form salts with the oxides of the metal on which they may be laid. Hence we must look for improvements in our paints to those substances among the organic groups which have greater stability than the fat or fixed oils, and which, in the place of being acid or Haloid, are basic or neutral. The heavy oily matter obtained from the distillation of resin, called "resenien," and eupion, obtained from rapeseed oil, have valuable properties as the bases of paints.

Tables IX. and X. contain the results as to the corrosion of cast iron in sea water when exposed in Voltaic contact with various alloys of copper and zinc, copper and tin, or either of these metals separately, per square inch of surface. It appears that neither brass nor gun metal has any electro-chemical protective power over iron in water, but on the contrary promotes its corrosion. This question is only a particular case of the following general question: viz. if there be three metals, A. B. C., whereof A. is electro-positive, and C. electro-negative, with respect to B., and capable of forming various alloys, 2 A + C. . . . A + C. . . . A + 2 C; then if B. be immersed in a solvent fluid in the presence of A., B. will be electro-chemically preserved, and A. corroded, and *vice versa*. If B. be so immersed in the presence of C., B. will be dissolved or corroded, and C. electro-chemically preserved; the amount of loss sustained in either case being determined according to Faraday's "general law of Volta-equivalents." The tables show that the loss sustained by cast iron in sea water, as compared to the loss sustained by an equal surface of the same cast iron in contact with copper, is 8·23 : 11·37 · and when the cast iron was in contact with an alloy containing 7 atoms of copper and 1 of zinc, the ratio was 8·23 : 13·21; so that the addition in this proportion of an electro-*positive* metal to the copper produces an alloy (a new metal, in fact) with higher electro-negative powers, in respect to cast iron, than copper itself. The author discusses many results equally remarkable, and is therefore enabled to suggest by its chemical notation the alloy of "no action," or that which in the presence of iron and a solvent would neither accelerate nor retard its solution, one of the components of this alloy being slightly electro-negative, and the other slighly electro-positive, with respect to cast iron. These results will also enable some advances to be made towards the solution of the important problem proposed by the author in his former report, viz. "the obtaining a mode of electro-chemical protection, such that while the metal (iron) shall be preserved, the protector shall not be acted on, and the protection of which shall be invariable."

Table X. exhibits especially the results of the action of sea water on cast iron in the presence of copper and tin or their alloys. It appears that copper and tin being *both* electro-negative with respect to cast iron, all their alloys increase or accelerate the rate of corrosion of cast iron in a solvent, though in very variable degrees; the maximum increase is produced by tin alone, thus indicating that this metal (contrary to what was previously believed) is more electro-negative to cast iron than copper. Hence the important practical deduction, that, where submerged, works in iron must be in contact with either alloy, viz. brass or gun metal; common brass, or copper and zinc, is much to be preferred. These experiments will also serve to demonstrate the fallacy of many of the patented so-called preservatives from oxidation, which are brought before the public with so much parade.

The author lastly proceeds to the subject of the specific gravity of cast iron, tables of which are added to the preceding. The specific gravities here recorded were taken on equal sized cubes of the several cast irons cut by the planing machine, from bars of equal size, cast at the same tempera[illegible] the same way, and cooled in equal times. Many of these results [illegible] siderably from those given by Dr. Thompson and Mr. Fairbairn [illegible] author refers to the probability that those of Dr. Thompson [illegible] pieces of the raw pig, and those of Mr. Fairbairn by [illegible] bulks cut from the mass by the chisel and file, by [illegible] volume is liable to condensation. The experim[illegible]